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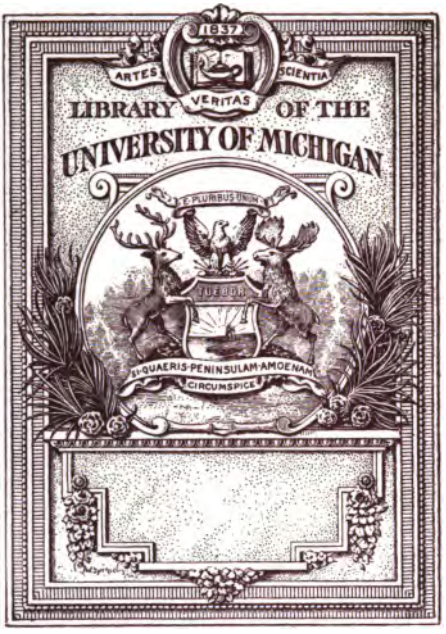

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EIGHTEENTH REPORT

(FIFTH BIENNIAL)

OF THE

STATE BOARD OF HEALTH

OF THE

STATE OF NEW HAMPSHIRE

FOR THE TWO YEARS ENDING NOVEMBER 1, 1904

CONCORD, NEW HAMPSHIRE
1904

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STATE OF NEW HAMPSHIRE.

OFFICE OF THE STATE BOARD OF HEALTH,
STATE HOUSE, November 1, 1904.

To His Excellency the Governor and the Honorable Council:

I have the honor to present herewith the eighteenth report of the State Board of Health.

Respectfully submitted,

Irving A. Watson

Secretary.

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REPORT.

An official report, such as is required by the Public Statutes, can represent in only a general way the work done and results accomplished. We have always maintained that educational methods were of the first importance in the work of the board, and for many years have depended almost entirely upon such a course; but now, and for nearly four years past, the board has had facilities, through the establishment of its laboratory, to make original investigations, which have already been of inestimable public benefit, and which is elsewhere in this volume quite fully reported upon.

Along what may be termed educational lines are included, first, a large and constant correspondence with local authorities and private citizens regarding general sanitary work, or specific and individual cases, concerning which information or advice is desired. In no instance has such a request been ignored; but, on the other hand, careful consideration has been given each case.

Further, whenever local problems arise in connection with sewerage, water supplies, contagious diseases, etc., making it necessary so to do, a representative from the state board of health makes a personal investigation, giving such advice as seems best in the case.

The duties of the state board of health, under the Public Statutes, are many and somewhat varied. It constitutes a department of vital statistics, and a board of commissioners of lunacy, the work of these two departments being represented by separate and special reports to the Legislature.

Vital Statistics.

All sanitary calculations are based upon vital statistics. Without them health officers would be groping in the dark so far as the results of their work are concerned. Sanitary legislation would be largely of a hit-or-miss character. Scientific methods could not be formulated for the suppression of disease. The importance of a given malady as a cause of death could not be determined—in fact, vital statistics are the measure by which we gauge and weigh, with approximate exactness, the movement of a population; whether increasing or diminishing, the mortality from different

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causes, the effect of seasons, climate, occupation, locality, and other environments upon which the health of individuals and communities depends.

Deductions from statistics of this kind, to be of greatest value, must cover a series of years and embrace large aggregates. The statistics of a single year reveal the facts as they exist at that time, but that, in itself, would be of but little service without like statistics for previous periods for comparison. Hence it is that the Registration reports, so apparently uninteresting and uninviting with their masses of figures, become indispensable in the study of all the great problems of public health, and, incidentally, many material interests.

We are fortunate in having a system of registration that is very accurate and complete, and without it the facts herewith presented would not be available from any source.

A calculation of the population of New Hampshire for each of the past twenty years, except census years, has been made by computing the relative increase in population between decennial census years, and it has been found to be approximately correct. Upon this basis, the population of the state of New Hampshire for the year 1902 was 418,888 and for 1903, 422,538.

It is upon these figures that all percentages to population for the past two years have been based.

The number of births, marriages, divorces, and deaths for the years 1902 and 1903 are given in the following table:

	1902.	1903.	Increase.	Decrease.
Births	8,249	8,318	69	.....
Marriages	4,061	4,004	.....	57
Divorces	482	518	36	.....
Deaths	6,649	6,969	320	.....

The proportion of births, marriages, divorces, and deaths to each 1,000 of the population for the two years mentioned was:

Year.	Births.	Marriages.	Divorces.	Deaths.
1902 . . .	20.04	9.69 (couples)	1.15 (couples)	15.87
1903 . . .	19.68	9.27 "	1.22 "	16.49

It will be seen that there was a marked increase in the number of deaths in 1903 over the number reported in 1902, an excess of 320. Notwithstanding this, the death-rate for the entire state for the year, 16.49 per 1,000, was the lowest, with one exception (the previous year ever reported.

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Deaths from Certain Specified Causes.

In the following pages are given some facts concerning the so-called "communicable" diseases, together with a few others that are worthy of careful consideration, and which, although belonging to the class considered as communicable and preventable, have not with our present knowledge been brought within control, as, for instance, pneumonia, influenza, bronchitis, etc. These diseases appear to be dependent to a certain extent upon climatic conditions, as well as subject to other influences.

Diseases.	1902.	1903.	Increase.	Decrease.
Pneumonia	618	686	68	.....
Tuberculosis (consumption)	569	530	.....	39
Diarrhœa and enteritis (cholera infantum)	291	328	37	.....
Diphtheria	136	77	.....	59
Croup	26	25	.....	1
Typhoid fever	72	86	14	.....
Influenza	51	80	29	.....
Scarlet fever	4	9	5	.....
Whooping cough	31	31	.....	.....
Measles	19	13	.....	6
Smallpox	6	.....	.....	6

Consumption (Pulmonary Tuberculosis).

Pulmonary tuberculosis, which, since civilized communities have kept records, has stood at the head of the list of causes of death, destroying more lives than plague, cholera, yellow fever, smallpox, or any other disease that has terrorized man, and which until within a very recent time has held supremacy in New Hampshire as a cause of death, is being very gradually conquered, its last year's mortality being less than ever before reported.

Not only is this true of our own state, but in all other states and countries where people have been instructed and efforts made to restrict and prevent it, a like diminution in its mortality is shown, all of which, were there no other proofs, demonstrates that it is a controllable disease.

The fact that consumption is being slowly suppressed under present methods is no reason why every effort known to science should not be put forth to reduce its mortality to far lesser proportions—as might be done.

For the past 20 years the annual death rate from pulmonary tuberculosis has been over 700, while for the year 1903 it was 530. The favorable exhibit herewith shown should not overshadow the fact that consumption is a far greater menace to life than all our epidemics, since it destroys nearly twice as many lives annually as typhoid fever, diphtheria, scarlet fever, measles, and smallpox combined. And although it is one of the preventable and controllable diseases, yet comparatively little concerted effort has been made to stay its ravages.

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The table herewith given shows the number of deaths from consumption reported annually for the past 20 years, together with its mortality by age periods:

Deaths from consumption (pulmonary tuberculosis) in New Hampshire for twenty years, by age periods.

Years.	Total.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.
1884	868	50	118	218	145	93	78	64	67	21	19
1885	857	49	98	219	161	109	75	75	43	19	9
1886	809	44	87	233	152	94	67	71	37	18	6
1887	766	34	88	193	145	101	78	55	46	21	5
1888	742	48	88	219	137	71	62	55	42	15	5
1889	651	36	81	147	120	77	56	65	53	10	6
1890	825	49	77	200	156	113	65	72	63	28	7
1891	695	47	87	174	131	89	67	37	44	10	10
1892	736	28	88	178	150	84	67	71	41	20	9
1893	787	45	71	204	139	92	65	64	34	14	9
1894	714	50	70	200	150	82	59	45	45	8	5
1895	693	31	66	210	129	85	60	49	51	10	2
1896	679	41	81	180	130	85	59	49	37	9	8
1897	697	36	79	225	143	70	46	49	32	12	5
1898	607	26	53	181	143	66	52	47	22	7	10
1899	582	26	57	169	108	80	65	38	28	10	6
1900	650	36	70	193	120	76	45	61	44	1	4
1901	629	42	57	178	130	71	53	48	40	7	3
1902	569	23	62	138	134	83	51	43	24	5	6
1903	580	26	47	141	107	66	54	49	31	7	2
Total	14,036	767	1520	3800	2725	1687	1224	1107	823	247	136

It will be seen that during the time embraced by this table there were 14,036 deaths from consumption. It should also be borne in mind that these figures do not include *all* the deaths due to tuberculosis, since if the mortality from tubercular meningitis, tubercular hydrocephalus, tabes mesenterica, scrofula, Pott's disease, lupus, and other tubercular conditions were added, the total would be considerably larger than the number given.

The reduction in the mortality from consumption during the past 20 years is vividly shown in the diagram:

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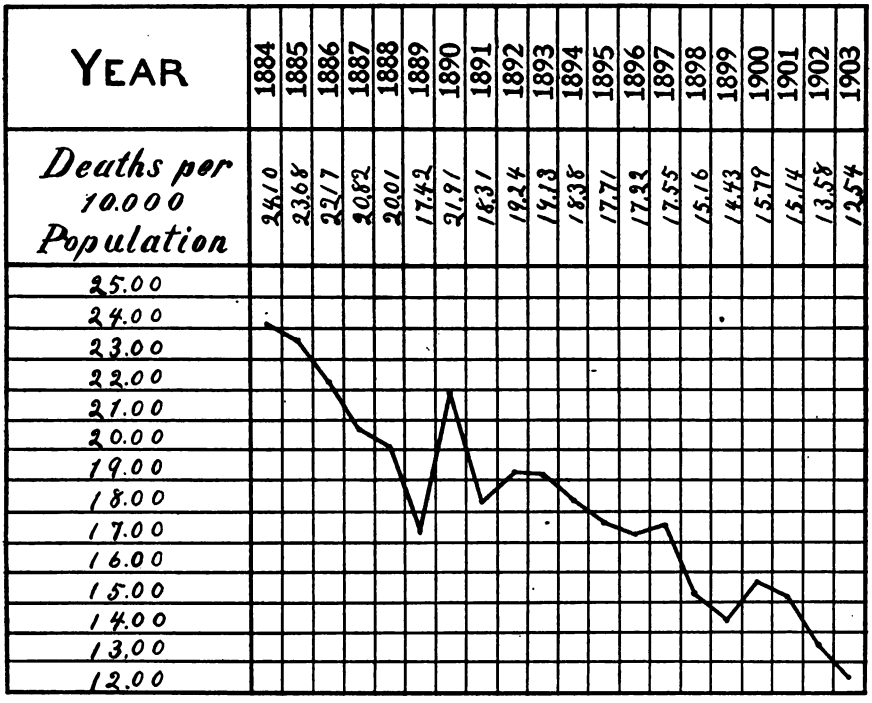
Chart showing deaths in New Hampshire from consumption per 10,000 population, for twenty years—1884 to 1903, inclusive.



In the year 1884 24.10 persons to each 10,000 of the population died of consumption, while in 1903 the rate was reduced to 12.54.

The effect of the first wave of the *grippe* epidemic in 1890 upon the mortality from consumption is shown in this chart.

If we divide the twenty years, 1884–1903, inclusive, into five-year periods, and average the mortality for each group, the result shows a marked and progressive decrease in the death rate from the disease for each successive period, and when represented in diagram shows at a glance the progress that has been made toward the suppression of the disease.

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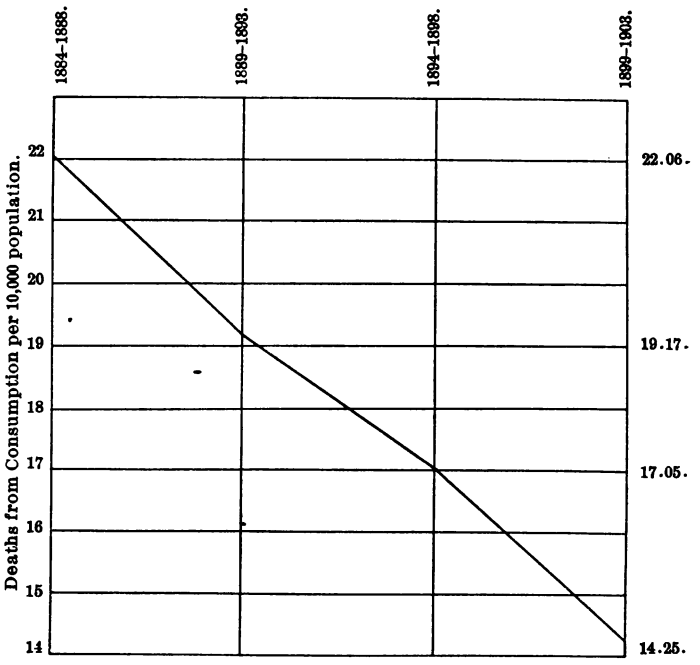
Decrease in the death rate from consumption in New Hampshire from 1884 to 1903—Five year periods.



If we calculate the mortality for this period in round numbers, by mean annual average, we have for 1884–'88, 808; 1889–'93, 728; 1894–'98, 678; 1899–1903, 592; percentage of decrease, 26.48; mean annual percentage of decrease, 1.32.

Deaths from consumption by age periods is shown in a foregoing table, and exhibited by percentages in the chart here inserted.

Unless sanatoria are provided for the treatment of indigent tuberculus patients and for those who have not the means sufficient to secure proper treatment, it is not to be expected that the rate of decrease in the mortality from this disease which has been shown can possibly be maintained. In all probability the diminution which has taken place has been largely among the so-called better classes, or, in other words, among the more prosperous, and perhaps more intelligent, part of the community. It is these persons who are better informed and pay more attention to sanitary progress, and who, moreover, have the means at their command to enable them to do so. To reduce tuberculosis to its lowest terms, sanatoria become a necessity.

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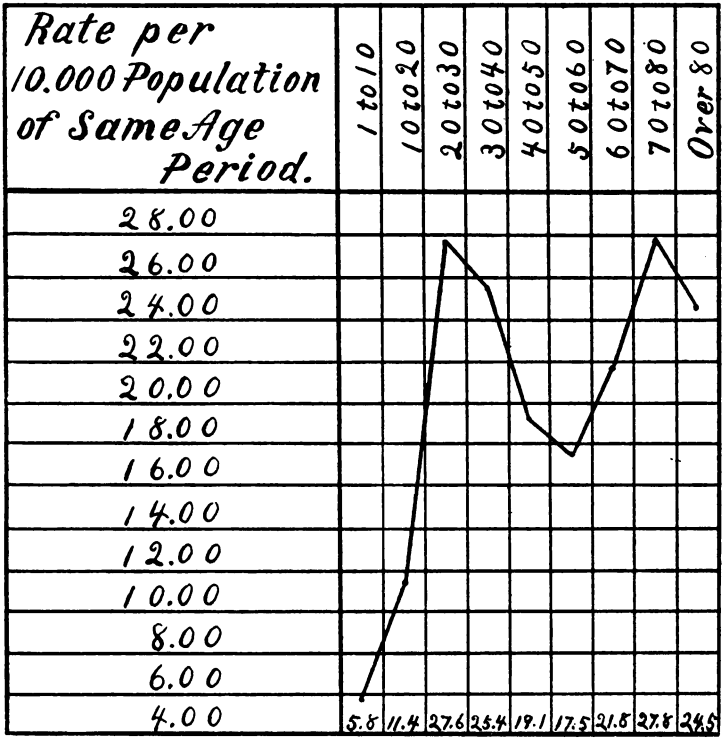
Chart showing deaths in New Hampshire from consumption per each 10,000 population of the same age period, for twenty years—1884 to 1904, inclusive.



It should be noted that the rates given are computed upon the population of the given age period. It will be seen that the period least susceptible to the disease is between one and ten, while the greatest is between twenty and thirty, closely followed by the period between seventy and eighty. In other words, the greatest liability to contract the disease is in persons between twenty and thirty years of age, and the next most liable period is between seventy and eighty.

The tremendous mortality of this disease among persons in the prime of life merits the careful consideration of all who are studying this disease.

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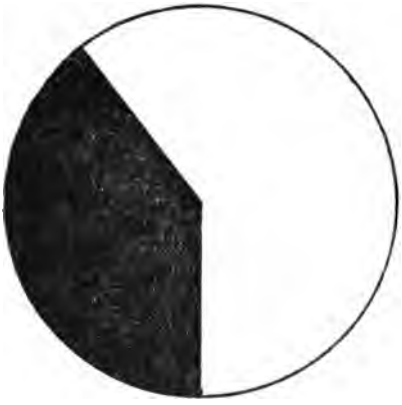
Diagram showing proportion of deaths from pulmonary consumption to deaths from all other causes in New Hampshire between the ages of twenty and thirty years, for a period of twenty years—1884 to 1903, inclusive:

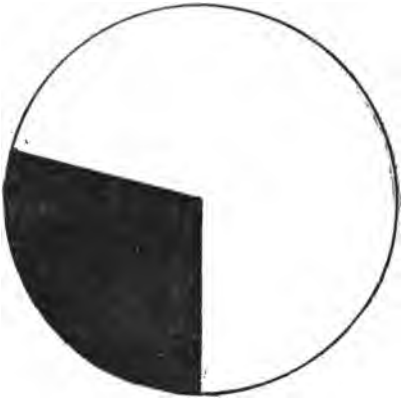


Black—Consumption.
White .. diseases.

During this period there died in New Hampshire, from all causes, between the ages of twenty and thirty, 9,612 persons, of whom 3,800 succumbed to consumption; or, in other words, 39.53 per cent., or one to two and a fraction deaths were caused by consumption.

Diagram showing proportion of deaths from pulmonary consumption to deaths from all other causes in New Hampshire between the ages of thirty and forty years, for a period of twenty years—1884 to 1903, inclusive:

Between thirty and forty years of age there were, from all causes, 8,752 deaths, and from consumption, in the same age period, 2,725, a percentage of 31.13, or one to every three and a fraction deaths.



Black—Consumption.
White—All other causes.

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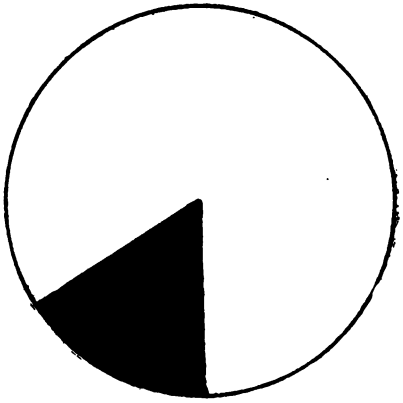
Diagram showing proportion of deaths from pulmonary consumption to deaths from all other causes in New Hampshire between the ages of forty and fifty years, for a period of twenty years—1884 to 1903, inclusive:

Between forty and fifty there was a total of 8,864 deaths from all causes, 1,687 of which were credited to consumption, equal to 19.03 per cent., or one in every five deaths.



Black—Consumption.
White—All other causes.

If we make our calculations on the entire period, twenty to fifty years, we find that 30.16 per cent., or one death in every three and a fraction, was due to pulmonary consumption.

Pneumonia.

Pneumonia is an infectious disease, acute in its character, and has become the most prominent cause of death in New Hampshire, as it has in many other sections of the country. For the past six years the annual mortality from this disease has been greater than that from consumption.

Mortality from Pneumonia in New Hampshire from 1883 to 1903, inclusive, by ages.

Years.	Under 1.	1 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Unknown.	Total.
1883.	82	.....	5	8	12	30	21	36	45	86	94	66	13	498
1884.....	51	48	3	3	6	27	23	30	36	50	97	54	8	436
1885.....	69	49	8	4	11	15	27	32	37	72	105	74	1	504
1886.....	57	38	13	6	13	17	24	29	49	68	92	53	7	466
1887.....	68	33	7	5	13	28	32	40	48	89	121	68	4	556
1888.....	67	45	6	10	19	40	49	51	62	67	123	81	8	628
1889.....	61	50	8	12	17	29	36	40	48	98	100	79	4	582
1890.....	78	48	9	10	11	35	46	45	79	106	127	107	7	703
1891.....	73	43	15	6	11	43	31	38	74	109	126	95	9	673
1892.....	77	49	13	6	12	41	61	60	95	147	190	128	11	890
1893.....	86	65	15	5	15	36	39	55	60	95	120	88	6	685
1894.....	88	62	13	4	11	29	38	48	68	87	103	83	4	633
1895.....	69	62	11	8	16	27	32	46	57	101	127	74	9	639
1896.....	103	96	8	5	10	22	29	35	34	68	82	63	2	557
1897.....	122	82	13	7	9	22	36	33	56	78	100	87	5	650
1898.....	84	68	12	7	9	25	35	34	31	59	101	55	4	524
1899.....	130	97	19	9	19	25	39	46	50	85	129	99	6	753
1900.....	142	125	14	11	18	48	64	76	95	112	141	88	8	942
1901.....	105	82	13	3	9	41	35	65	55	78	136	89	5	716
1902.....	118	86	14	7	10	35	31	32	51	76	82	73	3	618
1903.....	127	87	19	11	17	26	42	40	54	85	95	78	5	686
Total...	1,852	1,315	238	147	268	641	770	911	1,179	1,816	2,391	1,682	129	13,339

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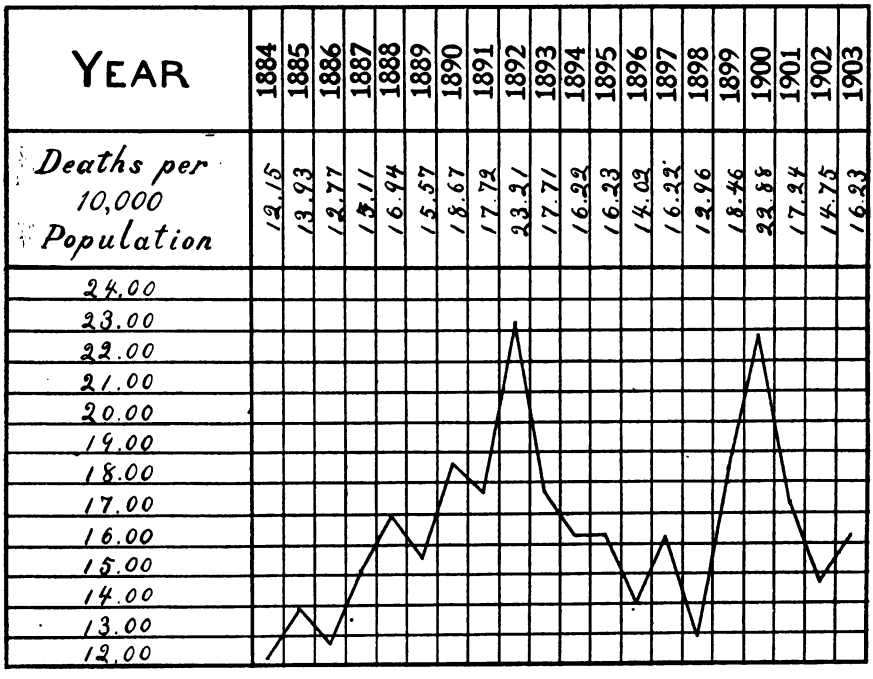
During the past 20 years, 1884–1903, inclusive, there were returned 13,339 deaths from this cause. The years of greatest mortality from this disease were 1892 with 890 deaths, and 1900 with 942 deaths, both these years being at the height of the greatest epidemics of influenza or *grippe* that have occurred.

The diagram herewith given is a graphic illustration of the variation in the mortality from pneumonia from year to year, showing the number of deaths to each 10,000 of the population.

Deaths in New Hampshire from Pneumonia per 10,000 population for 20 years ending December 31, 1903.



The last biennial report of this board, in discussing pneumonia, said: "The question of the prevention of pneumonia is more difficult to solve than that pertaining to some of the other communicable diseases. The aged, particularly, should guard against sudden changes in temperature, and should not expose themselves to such vicissitudes as will in any way shock the system or impair its normal resisting powers. In pneumonia the sputum should be disinfected, the mouth and throat kept clean and the most careful precautions taken against the infection of others. Disinfection of the room after recovery or death is, at least, advisable, and in

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the event that several cases occur in the same family, complete disinfection of the premises should be performed."

Studies which have been made since the above was written confirm these observations and emphasize the importance of carrying out the suggestions made in the most complete and thorough manner in every case of this disease. The effect of climatic conditions, temperature, etc., is shown in the fact that far the greater mortality occurs during the colder months of the year, while in the summer months its mortality is comparatively low.

By months the number of deaths from pneumonia was as follows: January, 2,067; February, 1,621; March, 1,786; April, 1,628; May, 1,188; June, 571; July, 330; August, 284; September, 356; October, 647; November, 892; December, 1,451.

Influenza.

This subject is an interesting study, not only in itself, but particularly in connection with the increased mortality at certain periods from pneumonia and consumption. The following table gives the number of deaths from influenza or *grippe* from 1884–1903, a total of 1,724. Its fluctuations are exceedingly marked. The greatest mortality occurred in 1892, when there were 331 deaths. For many years prior to 1890 it was scarcely known among the causes of death, but since that year its annual mortality, although flunctuating widely, has been considerable.

The second year of its greatest mortality was 1900, with 183 deaths.

A glance at the table herewith given shows the annual variation in the number of deaths from pneumonia, corresponding with the years of greatest mortality from *grippe*.

It has been further noted that the first wave, so to speak, of this disease, in its epidemic form in 1890 increased to a marked degree the number of deaths from consumption for that year, the increased mortality being represented, probably, by cases of so-called "quick" consumption.

It will be seen, therefore, that influenza is a disease of serious proportions, far more so than is represented by the number of deaths reported directly from it.

Deaths from influenza in New Hampshire for twenty years, 1884 to 1903.

Years.	No. of Deaths.	Years.	No. of Deaths.	Years.	No. of Deaths.
1884	8	1891	143	1898	51
1885	6	1892	331	1899	170
1886	5	1893	91	1900	183
1887	9	1894	121	1901	139
1888	6	1895	121	1902	51
1889	4	1896	47	1903	80
1890	33	1897	130		
Grand total					1,724

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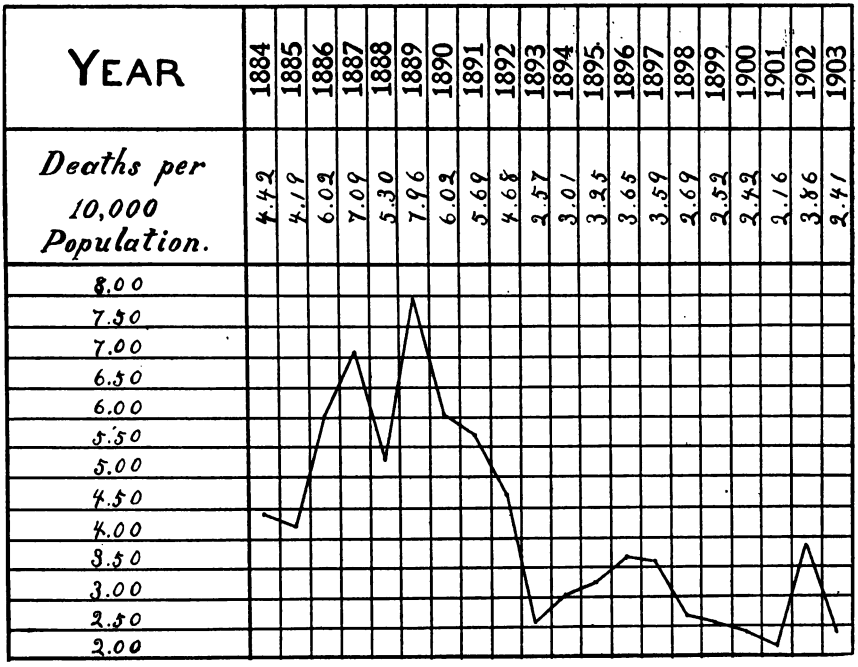
Diphtheria (and Croup).

Diphtheria and membranous croup are now known to be one and the same disease, differing only in manifestations; croup is, therefore, included in the figures herewith given. During the past twenty years, 1884–1903, inclusive, there were returned 3,204 deaths from this disease, or an average of 160 annually. In only one year since 1892 has the average been reached. Of the total number reported for the period named, 1,068 were returned as croup, which is exactly 33 1-3 per cent. of the total deaths classed as diphtheria. In other words, croup, or the laryngeal form of diphtheria, caused one third as many deaths as were returned under the term "diphtheria."

Diagram showing deaths in New Hampshire from diphtheria (and croup) per 10,000 population for 20 years ending December 31, 1903.



The diagram herewith inserted shows the number of deaths to each 10,000 of the population for each year from 1884 to 1903, inclusive. It will be seen that since 1892 there has been a marked decrease in the mortality from this disease. It is not at all improbable that the use of antitoxin since that time has been a powerful factor in this reduction.

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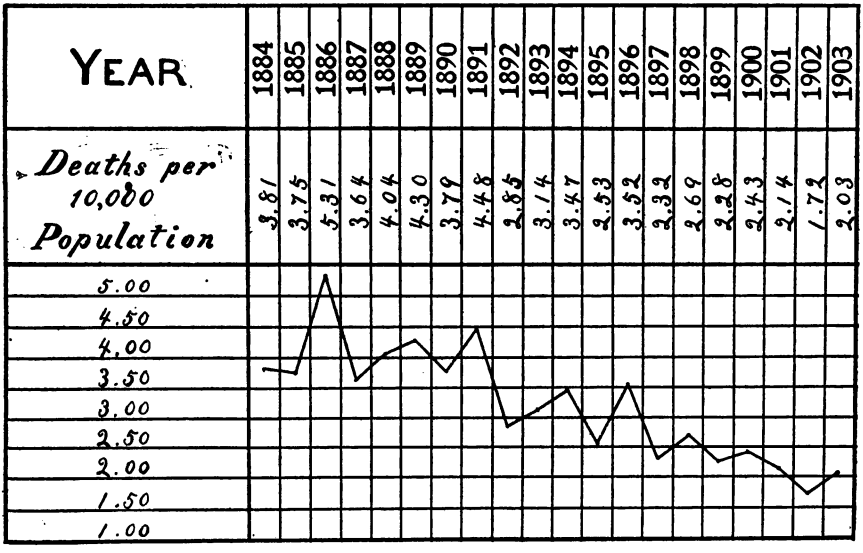
Typhoid Fever.

Although the mortality from typhoid fever fluctuates more or less from year to year, it is gratifying to note that it is being gradually reduced, and, notwithstanding some local outbreaks that might have been avoided, the mortality from this disease in 1902 and 1903 was the lowest ever returned in the state, the number being 72 and 86 for these years, respectively.

The cause of this gradual suppression of typhoid fever is due chiefly, and we might say almost wholly, to the improved condition of public and private water supplies. To what extent the work of the State Laboratory of Hygiene, in pointing out several hundred dangerous and suspicious sources of water supply, has been contributory to the reduction of typhoid fever during the last three years, since this work has been in progress, is a point which, although not provable, is worthy of consideration.

During the past 20 years there have been returned 2,467 deaths from typhoid fever in this state, or an annual average of 123+. The diagram herewith inserted shows the number of deaths to each 10,000 of the living population for each year of the period named.

Diagram showing deaths in New Hampshire from typhoid fever, per 10,000 population, for 20 years, ending December 31, 1903.



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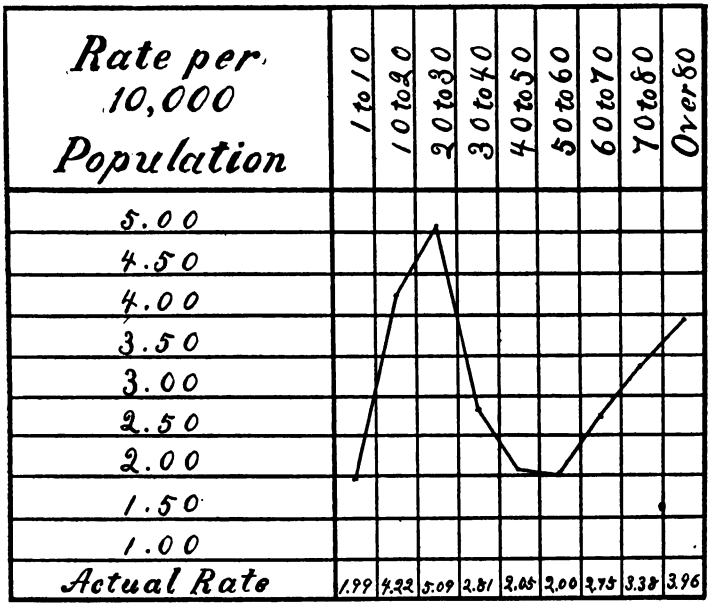
By age periods, the number of deaths were as follows: Between one and 10, 258; between 10 and 20, 556; between 20 and 30, 693; between 30 and 40, 306; between 40 and 50, 190; between 50 and 60, 142; between 60 and 70, 141; between 70 and 80, 111; over 80, 37; age not stated, 33. The rate per 10,000 of the living population of the same age period is graphically shown in the diagram. It will be seen that the greatest liability to the disease is in persons between the ages of 20 and 30 years, and from that period rapidly falls to the 60–70 period, after which there is a gradual rise for the remaining life periods.

Diagram showing death rate to each 10,000 population of the same age period.



Scarlet Fever.

In 1902 only four deaths were returned from scarlet fever in New Hampshire, and in 1903, nine deaths, these figures being the lowest ever reported in this state during its registration period.

The annual average number of deaths from this disease for the past 20 years was 31, the total number for that period being 623.

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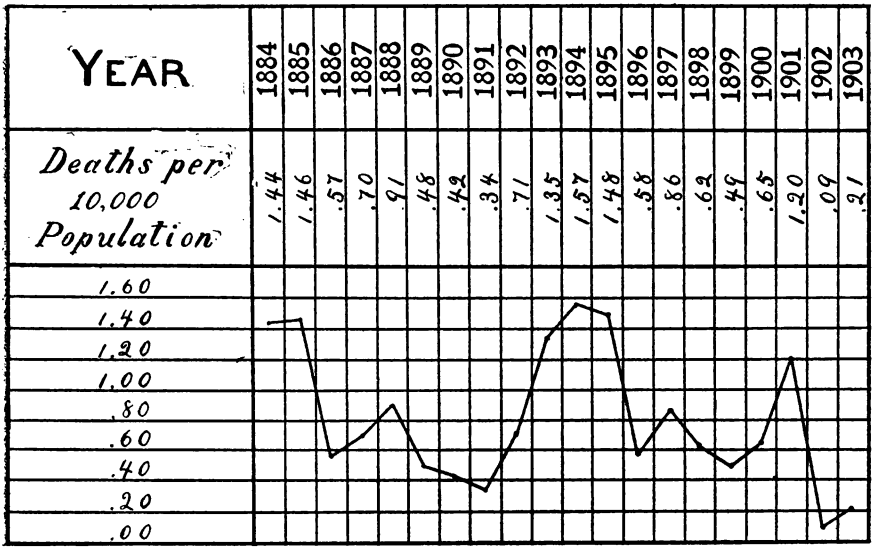
Diagram showing deaths from scarlet fever in New Hampshire, per 10,000 population, for 20 years, ending December 31, 1903.



The diagram herewith given shows the number of deaths to each 10,000 of the population for the years given, and vividly illustrates its annual variations. A local epidemic, uncontrolled, makes a marked difference, as illustrated under the year 1901, from the epidemic in Keene which resulted in 20 deaths.

The low general mortality from scarlet fever is doubtless due to methods of isolation and disinfection now carried out by local boards of health, and were it not for such precautions a much greater death rate would probably result. The mild, unrecognized, "walking" cases are the most prolific source of the spread of the infection, and are, by their very nature, beyond the control of health authorities.

Smallpox.

At the time of going to press with this report there is not a case of smallpox in New Hampshire, and has not been for several months. During the past two years there were reported to the board by local health officers 720 cases of smallpox, as against 636 cases for the two preceding years. It will, therefore, be seen that in four years we have had in New Hampshire 1,356 cases of smallpox that were reported to the State Board of Health, while it is quite possible that there may have been an occasional unreported case.

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The mild type in which the disease prevailed is evidenced by the fact that of this great total there were only 13 deaths.

The protective value of vaccination has been demonstrated during this outbreak in a most emphatic way. It is a fact that the person who keeps well vaccinated will not contract smallpox, and that if once successfully vaccinated, even in childhood, the danger of contracting the disease is exceedingly small.

Nearly all these cases doubtless exposed some vaccinated persons to the infection of the disease, and yet a case of varioloid seldom occurred. The board of health of Manchester, in handling 162 cases of smallpox in 1893, found but one case of varioloid.

The protective power of vaccination is so well proven that there ought to be no controversy, whatever, as to its value.

Following is a table showing the towns in which smallpox occurred during the two years ending November 1, 1904, with the number of cases in each:

Smallpox in New Hampshire for two years ending November 1, 1904.

Acworth	1	Hooksett	17
Allenstown	7	Laconia	22
Alstead	1	Lebanon	8
Bedford	1	Littleton	3
Berlin	98	Manchester	301
Bethlehem	1	Nashua	107
Candia	1	Newmarket	16
Claremont	28	Pembroke	15
Concord	4	Pinkham's Grant	18
Dover	4	Rochester	16
Enfield	1	Rollinsford	12
Epping	1	Somersworth	1
Errol	1	Tilton	6
Gilmanton	2	Wolfeborough	1
Gorham	3		
Greenfield	1	Total	720
Hancock	4		

Measles.

In 1902 nineteen deaths were returned from this cause, and in 1903 thirteen. During the past 20 years there have been reported in this state 396 deaths from measles, an annual average of 19+. By age periods, for the 20 years, the mortality was as follows: Under one year, 127; one to five, 170; five to ten, 28; ten to fifteen, 12; fifteen to twenty, 15; twenty to thirty, 12; thirty to forty, 11; forty to fifty, 4; fifty to sixty, 7; sixty to seventy, 3; seventy to eighty, 3; over eighty, 1; age not stated, 3.

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Whooping Cough.

For the years 1902 and 1903 there were exactly 31 deaths each year from whooping cough. Of the 62 deaths, 44 were infants under one year of age. No deaths among adults were reported from this cause.

Heart Disease.

Under this term, which in some respects is a misnomer, are returned more deaths than from any other disease except consumption and pneumonia, and in an occasional year these relative positions have been transposed. In 1898 heart disease ranked first as a cause of death in this state; in several years it ranked second; in a number of years third, and in one year fourth in order of fatality. The following table shows the number of deaths from this cause from 1884 to 1903, inclusive, with rate for each year, and also the average rate by five-year periods. It will be seen, when viewed in groups, that there has been a slight increase in each succeeding period.

Deaths from heart disease, 1884 to 1903.

Years.	Number of deaths.	Rate per 10,000 to estimated population.	
1884	507	14.12	
1885	489	13.51	
1886	510	13.98	Average rate for five years, 14.43.
1887	552	15.01	
1888	575	15.51	
1889	564	15.09	
1890	568	15.08	
1891	572	15.05	Average rate for five years, 15.15.
1892	571	14.89	
1893	605	15.64	
1894	649	16.63	
1895	691	17.55	
1896	647	16.28	Average rate for five years, 16.37.
1897	647	16.14	
1898	619	15.30	
1899	685	16.79	
1900	682	16.56	
1901	692	16.66	Average rate for five years, 16.89.
1902	701	16.78	
1903	747	17.67	
Total	12,273		

Cancer.

The reported general increase in cancer in many states and countries renders this subject one of vital importonce, and especially so considering the nature of the malady. It is gratifying, however, to learn that apparent progress is being made in the investigations of this disease, which leads one to believe that ultimately its true cause may be found and possibly a successful method of treatment. Scientific study is now being made of

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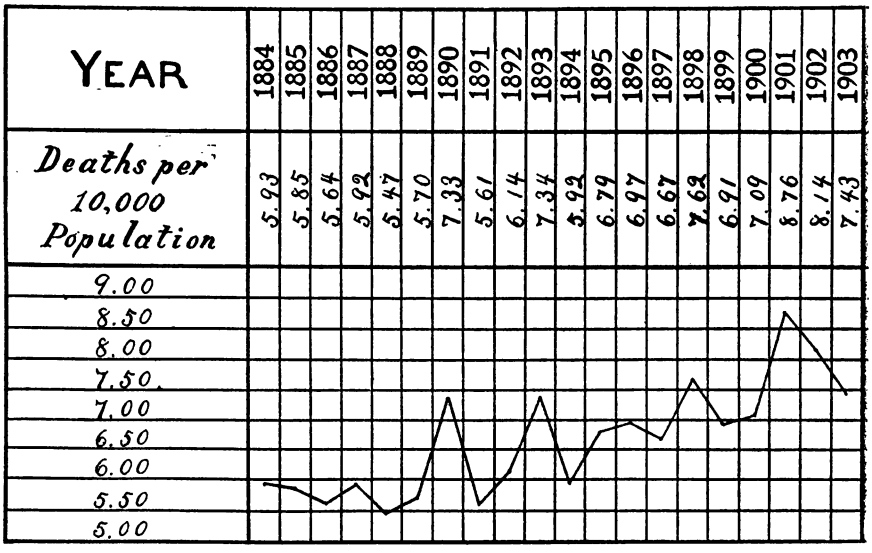
this disease in laboratories equipped with every facility and all that money can do, and it is not improbable that great results may be accomplished.

Table showing deaths in New Hampshire from cancer for twenty years.

Year.	Deaths from cancer.	Year.	Deaths from cancer.	Year.	Deaths from cancer.
1884	210	1891	222	1898	305
1885	218	1892	235	1809	279
1886	206	1893	283	1900	292
1887	218	1894	230	1901	364
1888	203	1895	266	1902	341
1889	213	1896	275	1903	314
1890	276	1897	265		

The above table gives the number of deaths from cancer in New Hampshire for the past 20 years. Its steady increase, only slightly fluctuating, is noticeable, and is vividly illustrated in the diagram, which shows the number of deaths from this cause to each ten thousand of the population for the years given. During this period there were returned 5,210 deaths from this disease, or an annual average of 260+. By age periods the deaths were as follows: From one to ten, 19; ten to twenty, 21; twenty to thirty, 65; thirty to forty, 283; forty to fifty, 643; fifty to sixty, 1,119; sixty to seventy, 1,376; seventy to eighty, 1,167; over eighty, 461; age not stated, 56.

Diagram showing deaths in New Hampshire from cancer per 10,000 population for twenty years, 1884 to 1903, inclusive.



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Apoplexy.

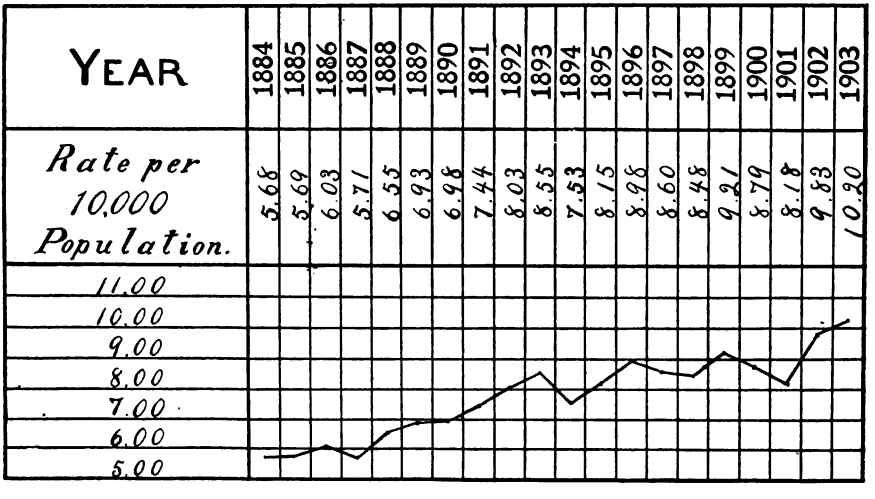
This is another cause of death that merits consideration on account of its slightly increasing proportions. The diagram illustrates this increase, which has been almost constant during the 20 years of our accurate registration period.

The table is inserted for the purpose of showing the total number of deaths from this cause and also the age period of the decedents.

Deaths from apoplexy by age periods, 1884 to 1903, inclusive.

Years.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.	Total.	Percentage to total population. (Per 10,000.)
1884	6	1	3	14	8	21	52	61	34	4	204	5.68
1885	2	1	4	12	16	26	44	69	30	2	206	5.69
1886	2	1	1	12	16	24	48	81	32	3	220	6.03
1887	3	..	5	11	14	24	56	53	43	1	210	5.71
1888	4	....	3	6	12	19	59	75	64	1	243	6.55
1889	2	....	6	4	16	43	65	74	48	1	259	6.93
1890	1	1	3	6	19	38	58	82	50	5	263	6.98
1891	7	1	8	10	22	31	61	90	49	4	283	7.44
1892	....	....	1	5	20	50	73	93	57	9	308	8.03
1893	3	....	5	9	21	37	82	108	61	5	331	8.55
1894	2	1	3	4	12	42	79	105	44	2	294	7.53
1895	1	2	6	9	16	45	67	112	59	4	321	8.15
1896	2	....	5	8	21	52	90	116	59	4	357	8.98
1897	3	....	9	8	15	48	76	104	77	5	345	8.60
1898	4	.. .	4	7	20	53	73	112	63	2	343	8.48
1899	2	2	4	9	30	53	88	126	63	4	376	9.21
1900	2	1	6	7	18	55	87	105	72	9	362	8.79
1901	1	2	4	13	28	38	92	102	58	2	340	8.18
1902	12	....	5	5	25	53	105	136	67	4	412	9.83
1903	10	2	8	14	35	63	99	117	81	2	431	10.20
Total	69	15	93	173	384	815	1,449	1,921	1,116	73	6,108	

Diagram showing death rate from apoplexy to each 10,000 population, 1884 to 1903, inclusive.



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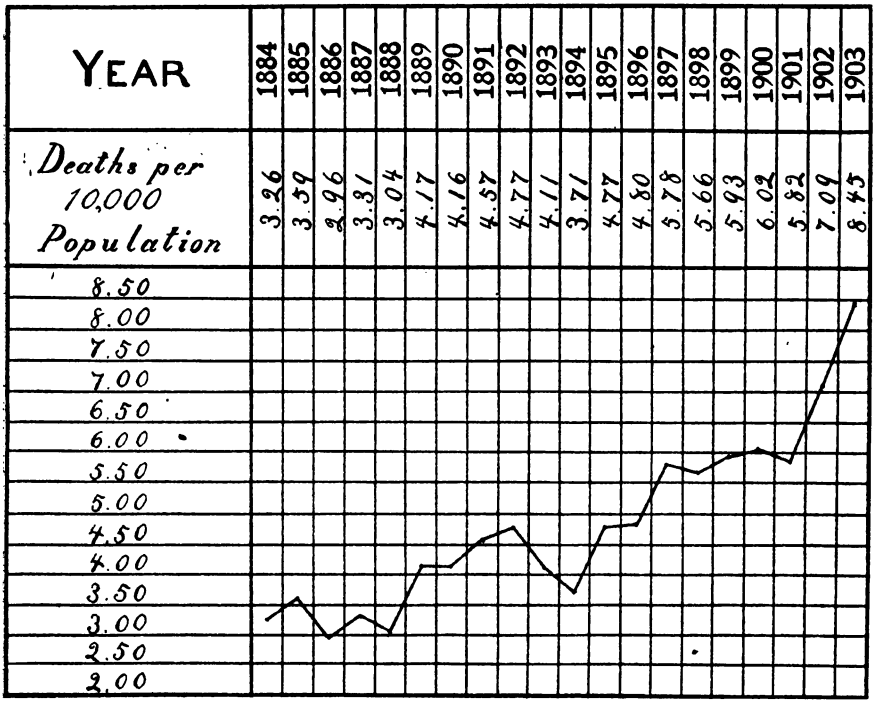
Bright's Disease.

This is one of the most serious chronic diseases with which we have to contend. A somewhat startling increase in its mortality should mark this subject for special study by physicians and sanitarians. The cause, if preventable, as it doubtless is to a greater or less extent, should be pointed out as a matter of public instruction. Some of our ablest writers place over-eating, especially of meats, first in the list of causes. Perhaps, as contributory causes, should be considered adulterated foods and those to which preservatives have been added, the use of alcoholic liquors, lead in drinking water, hereditary influences, irregular habits with nerve tension —in fact, everything that continuously impairs or disturbs the normal functions of digestion, assimilation and elimination may probably be considered either as predisposing to, or actually causative of, kidney degeneration.

The actual progress that the disease has been making is more graphically illustrated in the diagram herewith given, which shows the number of deaths from it to each 10,000 of the population from 1884 to 1903, inclusive.

Diagram showing deaths from Bright's disease to each 10,000 population, from 1884 to 1903, inclusive.



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That its actual mortality, as well as the ages of decedents, may be studied, the following table is given.

Deaths from Bright's disease by age periods, 1884 to 1903, inclusive.

Years.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.	Total.	Rate per 10,000 population.
1884	6	6	9	13	12	23	20	23	3	2	117	3.26
1885	6	9	11	19	15	14	24	24	7	1	130	3.59
1886	3	2	9	8	8	10	28	33	6	1	108	2.96
1887	4	6	6	17	12	16	29	25	6	1	122	3.31
1888	9	3	6	3	15	20	25	25	5	2	113	3.04
1889	3	3	11	16	19	28	34	33	8	1	156	4.17
1890	5	5	5	14	16	24	35	39	11	3	157	4.16
1891	2	9	7	18	16	27	46	34	10	5	174	4.57
1892	7	6	10	16	24	35	37	36	9	3	183	4.77
1893	13	7	10	18	18	18	29	39	7	....	159	4.11
1894	10	6	14	12	20	24	22	30	6	1	145	3.71
1895	4	8	13	17	23	37	34	38	13	1	188	4.77
1896	6	10	9	18	17	32	39	43	15	2	191	4.80
1897	15	3	11	24	15	38	46	56	20	4	232	5.78
1898	5	7	16	16	15	35	51	65	16	3	229	5.66
1899	11	6	12	16	23	31	50	71	21	1	242	5.93
1900	12	5	15	14	34	35	49	61	20	3	248	6.02
1901	7	5	15	22	26	47	57	44	17	2	242	5.82
1902	3	4	19	20	33	43	64	77	25	4	297	7.09
1903	8	8	18	23	39	58	74	81	36	4	349	8.45
Total	144	118	226	324	400	595	793	877	261	44	3,782	

Increasing and Decreasing Causes of Death.

In the foregoing review of some of the specified causes of death we have shown that there has been a marked diminution in the death rate of nearly all of the so-called contagious and infectious diseases, which lessened mortality has doubtless been due to intelligent preventive and supervisory methods employed in dealing with these diseases.

On the other hand, some of the more prominent causes of death, the mortality from which is increasing from year to year, have been exhibited for the purpose of calling especial attention to these facts, with a view to developing an interest in the subject, and in means and methods of controlling, as far as possible, their ravages.

The gratifying feature found in a review of the entire field, so far as the causes of mortality are concerned, is, that notwithstanding the greatly increased death rate from certain diseases, the total mortality of the state was never so low as at the present time. If the increased death rate in the certain diseases referred to were not offset by a more than corresponding diminution in other maladies, the death rate for the state would be increasing, instead of decreasing, as it is.

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The Indigent Insane.

As a board of commissioners of lunacy, we have transferred to the New Hampshire State Hospital, for remedial treatment, during the period covered by this report, 307 patients, while the whole number receiving such treatment, including those previously committed during the two years, was 369, and at the close of the period represented, September 30, 1904, there remained at the State Hospital under remedial treatment by order of the board, 208 persons. During this period a fraction over 15 per cent. of the cases were discharged recovered. In this connection the following table may be of interest:

The following shows the number of commitments, discharges and deaths of insane persons at the institutions named, during the year ending September 30, 1904, also the number of inmates remaining at these institutions at the latter date, as shown by the records of the board.

Asylums for Insane.	Inmates, October 1, 1904.	Commitments during the year ending September 30, 1904.	Discharged.	Deaths.
New Hampshire State Hospital	580	303	143	69
Rockingham County Asylum	56	12	11	4
Strafford County Asylum	4	4	4	....
Belknap County Asylum	8	.....	.....	2
Carroll County Asylum	7	.....	1	1
Merrimack County Asylum	25	2	13	4
Hillsborough County Asylum	74	14	18	4
Cheshire County Asylum	37	3	8	1
Sullivan County Asylum	8	1	1	2
Grafton County Asylum	14	.....	4	1
Coös County Asylum	13	1	10	....
Total for state	826	340	213	88

The number of insane persons at the several institutions in the state on October 1, 1904, was larger than ever before reported. The number returned for each year since the creation of this board is as follows: 1889, 634; 1890, 657; 1891, 674; 1892, 670; 1893, 629; 1894, 684; 1895, 712; 1896, 725; 1897, 730; 1898, 733; 1899, 764; 1900, 760; 1901, 768; 1902, 736; 1903, 759; 1904, 826.

Local Boards of Health.

It has been the aim of the State Board of Health to keep in close touch with the local boards throughout the state, and to give them all the aid and information possible in matters pertaining to their official duties. Many letters, circulars, pamphlets, etc., are distributed to this end.

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Copies of sanitary laws, placards, blanks for reports, etc., are forwarded from the State Board. Special advice is given in all difficult matters confronting local boards of health, when requested, and occasionally an inspector is sent to assist them.

While this volume is in press a School of Instruction for Health Officers and Sanitary Conference is being held. The following programme shows the topics being considered, while the discussions that follow, and the numerous questions asked in connection with the execution of sanitary work make such a conference of great value to local health officers.

PROGRAMME.

Wednesday, December 14, 1904, Morning Session, 11 o'clock.

1. Calling meeting to order, by Granville P. Conn, M. D., president State Board of Health.
2. Announcements, by Irving A. Watson, M. D., secretary State Board of Health.
3. Address of welcome, by His Excellency, Hon. N. J. Bachelder, governor of New Hampshire.
4. Paper, "Some Erroneous Ideas about Water Supplies and Water Works," by Robert Fletcher, Ph. D., C. E., president and engineer Hanover Water Works, member State Board of Health.
5. Discussion.

Afternoon Session, December 14, 2.30 o'clock.

6. Paper, "Some Thoughts on Sanitation," by G. P. Conn, M. D., president State Board of Health.
7. Paper, "Duties of Boards of Health in Suspected Cases of Smallpox," by George Cook, M. D., Concord.
8. Paper, "Examination of Milk Supplies," by Carl O. Seaman, inspector of milk, Manchester.
9. Discussion of papers.

Evening Session, December 14, 7.30 o'clock.

10. Paper, "The Duties of Health Officers," by Henry D. Holton, M. D., secretary Vermont State Board of Health, Brattleboro.
11. Paper, "The Adulteration of Food Products" (with specimens, etc.), by H. E. Barnard, B. S., chemist State Laboratory of Hygiene, Concord.
12. Discussion of papers.

Evening Session, December 15, 7.30 o'clock.

19. Paper, "The Tuberculosis Problem, and Some Suggestions in Dealing with It," by Edward O. Otis, M. D., president Boston Association for the Relief and Control of Tuberculosis, Boston, Mass.

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20. Paper, "The Open-Air Treatment of Consumption" (illustrated with the stereopticon), by Frederick L. Hills, M. D., assistant superintendent New Hampshire State Hospital, Concord.
21. Discussion.

Friday, December 16, Morning Session, 9.30 o'clock.

22. Announcements, by State Board of Health.
23. Unfinished business.
24. New business.
25. Questions and answers.

Water Supplies.

The work now being done by the board in the direction of better protection for public and private water supplies is large, as will be seen by special reports elsewhere. The importance of this work is beyond calculation, in that it places a safeguard about the health of communities. Many sources have been found to be polluted to a dangerous extent and have been closed; other supplies have been pointed out as suspicious, and in these cases efforts are being made to secure water from better sources. Many samples from summer-resort localities have been analyzed, and no efforts are spared in this, and in other directions, to protect the health of the summer visitor.

The most notable instance of the abandonment of a dangerous water supply and the substitution of another of undoubted quality was at Littleton, a special report upon which may be found on page 107.

It is the purpose of the board to analyze samples from all the public water supplies of the state at least once in four months, and to this end the coöperation of the management of such supplies is solicited.

The Chlorine Map.

Nearly every portion of the state has been covered by careful successive analyses of unpolluted waters, for the purpose of determining the normal chlorine in the uncontaminated waters of every town in the state. It is necessary to have such data in order to calculate the significance of the amount of chlorine found in public and private water supplies. Had the state not been covered in this manner and the facts secured, it would be impossible to determine whether a given sample of water did, or did not, have an excessive amount of chlorine. If found in excess of the normal amount, it points to pollution from some source or other, which is generally easily traced. In some cases it also serves as a warning of danger, which should be heeded. Its significance, therefore, is important, and for this reason it became necessary to make the investigations to determine the normal chlorine.

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The Sanitary Bulletin.

The *Sanitary Bulletin* has been issued quarterly for the past five years, and it is believed to have accomplished an educational purpose that more than justifies its publication. It is a medium through which the State Board of Health reaches local authorities and the public in a manner that could not be done without means of this kind. Some of the recent issues have contained reports upon the analysis of foods at the State Laboratory of Hygiene, which has already done much to prevent the sale of adulterated and fictitious foods in this state. The aim has been to place these reports in the hands of every dealer in the state, and to that end as complete a list of wholesalers and retailers as it is possible to obtain is kept as a mailing list.

The fact that this publication is accepted as second class matter makes it possible to distribute it widely with small expense.

Records Copied, and in the Office of the Board.

The earlier records of births, marriages and deaths were returned to the state upon large sheets, which were folded and tied up in packages and packed away, and therefore inaccessible for reference purposes.

The Legislature of 1901 passed a joint resolution providing for the indexing of these records. Upon considering the question it was decided that the most feasible way to make them serviceable was to have each record copied upon a card by itself, and to file them in the same manner that similar records in the past few years have been. Five clerks have, therefore, been employed for several months upon this work, and it is now so nearly completed that the services of four of them have been dispensed with, and the remainder of the work will soon be finished.

Up to the present time 250,169 individual records have been copied and filed, and thus made available for immediate reference. There are now on file in the department of vital statistics in the vicinity of probably 750,000 to 800,000 individual records of births, marriages and deaths which have occurred in New Hampshire.

It is needless to say that these records are frequently consulted and that in many instances they have proven to be of great value. Many of them constitute the only record of the case in existence. Means to protect these valuable records from fire should be provided without unnecessary delay.

The Treatment of Indigent Consumptives.

The last Legislature appropriated $5,000 for each of the years of 1903 and 1904, for the purpose of providing remedial treatment for indigent

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consumptives. This work has been carried out by the State Board of Charities and Correction, with the usual satisfactory results that come from sanatorium treatment.

The report of the board referred to shows that 46 patients received treatment under the provisions of the act referred to, 45 being treated at a sanatorium in New Hampshire, and one in a similar institution in New York. Of the 45 referred to, when discharged, 8 per cent. were arrested cases, 74 per cent. improved and 18 per cent. unimproved. Only five of these cases when received were in the incipient stage of the disease, while the remainder were nearly equally divided between well-marked and advanced cases.

The fact that so excellent results were secured from this class of cases must be considered, in the light of former experience with the disease, as remarkable, and, further, as one more among the many proofs that sanatorium treatment is far in advance of any other in its results.

For further statistics and details concerning this work reference should be had to the report above referred to.

Sulphate of Copper in the Destruction of Algæ in Water Supplies.

Considerable interest has recently been aroused in a report by George T. Moore, physiologist and algologist in charge of laboratory of plant physiology, United States Department of Agriculture, on experiments with sulphate of copper in the destruction of fresh water algæ.

These microscopic plant growths, at certain times of the year and in certain waters, produce a fishy taste and an objectionable odor, and it has been found to be a serious problem to deal with them.

In the experiments referred to the amount of sulphate of copper used varied with the conditions, the character of the aquatic plants, etc., but approximated one part to one million parts of water to be treated.

Other experiments of this kind carried on in different parts of the country have been generally successful. Enough has been accomplished of a satisfactory nature to lead to the belief that the agent will prove to be of great value when the essentials to success are fully understood and complied with.

In this volume will be found a report on the treatment of the water supply of Hanover by this method. In these experiments one part sulphate of copper to four million parts of water, was the proportion, as nearly as could be estimated, and the results were most satisfactory.

Prof. H. N. Kingsford, who made the experiments, states that in his opinion the greatest, and practically the only, danger in employing this

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treatment is its destructive effect upon fish, and that in no case should it be used without first becoming familiar with the bottom of the reservoir or pond. In Professor Kingsford's opinion the failures reported have been due to unfamiliarity with the particular case to be dealt with.

We suggest that this matter is worthy of consideration by all water companies whose supplies are rendered objectionable by the growth of algæ.

Laboratory of Hygiene.

The very large amount of work done in the State Laboratory of Hygiene is quite fully reviewed in this report. The work of the chemical department has been largely devoted to the analysis of water supplies and the investigation of food products, and in these directions a large amount of labor has been accomplished. The same remarks are applicable to the bacteriological department. It will be seen that the investigations which have been made have been many and of inestimable value in connection with the diagnosis of tuberculosis and diphtheria. The interpretation of bacteriological examinations is not, in some cases, so thoroughly understood as is desirable. Upon these points we would refer to page 221, concerning the interpretation to be placed upon results in the examination of sputum, and to page 228 upon similar points in connection with diphtheria.

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WATER SUPPLIES OF TOWNS AND CITIES.

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EXAMINATION OF WATER SUPPLIES.

In the report of the State Board of Health for 1901–1902 is included under this title a discussion of the sources of water supply of the state, the results of the analyses made at the Laboratory of Hygiene, and the methods employed in collecting and analyzing samples. The work has been continued during the past two years along similar lines, although the constantly widening field has brought new problems and suggested new ideas for study.

It has been the desire of the laboratory to make analyses of all public water supplies at regular intervals, and in that way to keep under a constant supervision the quality of these waters, that are the only supplies of more than half the people of the state. In making these analyses we have had to depend upon the owners and superintendents of the water works to collect and ship us the samples, and as in many cases the importance of the work has not been understood by them, it has been impossible to make as frequent examinations as are desirable.

We have done enough, however, to establish fully the fact that all water supplies, no matter how pure they may appear, are liable to contamination, and need frequent analyses as a protection against pollution from unknown sources. In several instances we have discovered signs of a pollution that when investigated disclosed a serious condition of the water. It will be our policy in the future to make analyses of all public supplies at least four times a year, and if the conditions are at all unusual or unsatisfactory, as frequently as is necessary to determine the true quality of the water.

Since the establishment of the Laboratory of Hygiene we have made sanitary analyses of water whenever requested to do so by owners and users of supplies. As a result of this unconditional policy we have been compelled to analyze very many samples from sources that were not exposed to pollution and whose purity was unquestioned.

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While the value of such analyses may be considerable to the owner of the supply who has a personal pride in having his spring or well pronounced "pure," they are of little importance in removing sources of infection and disease and do not concern the public health in any way whatever. We have therefore decided that in the future all requests for analyses must be made either by local boards of health or at the advice of a physician, and that no waters will be analyzed unless accompanied by a satisfactory explanation of the reason for the request.

During the past two years 1,577 water samples have been analyzed. In order to show clearly the results of these analyses we have prepared the following tables and diagrams, which represent in a graphic manner the general character of our water supplies:

Diagram No. 1.—Showing total number of water supplies examined, and the sources from which they were derived.

1577. Total number of supplies examined.

947. Well supplies.

414. Spring supplies.

104. Pond supplies.

112. Stream supplies.

Diagram No. 2.—Showing total number of public water supplies examined, and the sources from which they were derived.

266. Total number of supplies examined.

96. Stream supplies.

90. Pond supplies.

48. Spring supplies.

32. Well supplies.

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Diagram No. 3.—Showing results of examinations of water supplies.

1577. Total number of supplies examined.

864. Good.

507. Bad.

206. Doubtful.

713. Bad and doubtful considered in one class.

Diagram No. 4.—Showing results of examinations of private water supplies.

1311. Total number of supplies examined.

618. Good.

503. Bad.

206. Doubtful.

693. Bad and doubtful considered in one class.

Diagram No. 5.—Showing results of examinations of public water supplies.

266. Total number of supplies examined.

246. Good.

4. Bad.

16. Doubtful.

Diagram No. 6.—Showing results of examinations of private well supplies.

915. Total number of well supplies examined.

413. Good.

361. Bad.

141. Doubtful.

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Diagram No. 7.—Showing results of examinations of private spring supplies.

366. Total number of spring supplies examined.

186. Good.

137. Bad.

43. Doubtful.

309. Total number of good supplies, ignoring the presence of lead.

Diagram No. 8.—Showing results of examinations of pond supplies.

104. Total number of pond supplies examined.

89. Good.

3. Bad.

12. Doubtful.

Diagram No. 9.—Showing results of examinations of stream supplies.

112. Total number of stream supplies examined.

98. Good.

4. Bad.

10. Doubtful.

Of the waters from the 1,577 supplies examined, 864, or 54.1 per cent., were of such quality as to be above suspicion, and were reported as good; 507, or 32.1 per cent., were without doubt polluted and unfit to drink; and 206, or 13.8 per cent., were neither good enough to be included in the first class, nor polluted to such an extent as to make them wholly unfit for use. This last class, which we will call doubtful, includes waters that

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have received pollution in the past but at present are not being contaminated, or, if so, by only small quantities of fitered sewage.

To make the comparison more clearly seen, and since sooner or later the doubtful waters will become polluted, let us consider but two classes of water, good and bad. Then of the 1,577 waters we find 864, or 54.1 per cent., good, and 713, or 45.9 per cent., bad.

But this table includes all waters analyzed, among which are 266 samples from public supplies; 92.5 per cent. of which were good, 1.5 per cent. bad, and 6.0 per cent. of doubtful quality. Since such a great proportion of the public supplies are pure, the addition of these figures to those of the private supplies makes the latter appear more satisfactory than they really are.

Deducting analyses of waters from public supplies we find that of 1,311 private supplies, 618, or 47.1 per cent., were good; 503, or 38.4 per cent., were bad, and 190, or 14.5 per cent., were doubtful; or, classing bad and polluted waters together, 693, or 52.9 per cent. of the supplies examined, were bad.

The percentage of pure supplies is somewhat lower than that given in the last report, for the reason that included in the list of bad waters are a great many supplies that were condemned because they contained large amounts of lead, but which, if free from lead, would be of good quality.

We have made another classification based on the sources of these waters, and considered them as surface, spring, and well waters; and since the surface waters received were of two classes we have further subdivided this source into pond and stream waters. One hundred and four pond waters were examined and 89, or 85.6 per cent., were found to be potable, or, in other words, of good quality for drinking purposes; 3, or 2.9 per cent., were bad; and 12, or 11.5 per cent., were doubtful. It is true that several of the waters classed as good contained an excess of vegetable matter during a portion of the summer, but this condition is only temporary, and usually produces no ill effect.

Of 112 stream supplies, 98, or 87.5 per cent., were of good quality; 10 or 8.9 per cent., were doubtful; and 4, or 3.6 per cent., were bad.

Very few private supplies are obtained from ponds or streams, and the figures given above apply, with but few exceptions, to the public supplies.

Of 366 spring sources, 186, or 50.9 per cent., were good; 137, or 37.4 per cent., bad; and 43, or 11.7 per cent., doubtful. These figures do not express the sanitary condition of our springs, for 114 of the 137 bad supplies were naturally very pure, but contained lead in considerable quantities, and were necessarily reported as bad. If we ignore the effect of the lead, or, better, consider the condition of the water at its source, we find

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that of the 366 spring waters examined, 309, or 84.4 per cent., were potable.

Besides the large number of spring waters condemned for drinking because of the great amount of lead present, many other supplies were also contaminated by lead and probably, in many cases, should also have been classed as unfit for use. But the fact that a great number of spring supplies are conveyed through lead pipe and that in many instances the cost of relaying with iron or tin-lined lead pipe is prohibitive, has made it seem best not to condemn all waters containing lead. We have therefore considered that where no injurious effects of lead had been observed, with due caution, water containing as high as .0400 parts of lead per 100,000 can be taken without injury. It is true that in some cases even .0400 parts of lead per 100,000 has produced marked injurious effects, but in the great majority of cases, where there is no unusual susceptibility to lead poisoning, the presence of this amount has been followed by no ill results. We showed in our last report that marked symptoms of lead poisoning developed in 55 per cent. of the families using water containing lead, and we suggested that, in view of this great risk, all waters flowing through lead pipe should be analyzed for the purpose of finding the character of the water and its effect upon the pipe, and that, wherever possible, some other form of pipe should be substituted.

When lead pipe is in use great care should be taken that the water is not allowed to stand in the pipes, but is delivered to the user in a constantly flowing stream. If, however, it is impossible to allow the water to flow continuously, the pipes should be emptied before drawing water for use.

We hope that whenever new supplies are to be connected for drinking or domestic purposes, some other form of pipe than lead will be employed, and that, as rapidly as possible, all lines of lead pipe will be discontinued in favor of some more suitable pipe.

Considerably more than half the samples analyzed have been from private well supplies, and the results obtained are of the utmost importance in showing the condition of the water which is used by nearly one half the families of the state. While spring supplies are common in some towns, by far the greater part of our population not provided with public service depend upon the well supply for water for drinking and domestic use.

Of the 915 private well supplies analyzed 413, or 45.1 per cent., were pure; 361, or 39.4 per cent., were bad, and 141, or 15.5 per cent., were of doubtful quality. Or counting both bad and doubtful waters in the same class, we find that 502, or 54.9 per cent., of the well waters examined,

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were unsuitable for use. These figures show a decided improvement over those obtained as a result of the first two years' work of the laboratory, when but 34.3 per cent. of the well supplies were found to be of acceptable quality. Ninety-nine of the 361 bad supplies were so classed because lead was present in excessive quantities, and it is probable that with some other form of service pipe they would be suitable for drinking.

It is not surprising that many wells are polluted, because the universal custom of grouping the house, barn, and water supply within easy reach of each other has made the well the center of drainage area for all household sewage and farm yard waste. Great numbers of these old wells are still in common use, and, save where analysis has proven the water to be a filtered sewage, of good repute in the community.

The importance of an analysis of these well waters cannot be overestimated. In some towns where the public sentiment has been aroused, series of analyses have shown that not a single well in the thickly settled villages has been suitable for use, because of the presence of sewage effluents. Where such conditions exist, and our results convince us that they are by no means uncommon, a water supply, brought from some uncontaminated source, becomes a public necessity.

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WATER SUPPLIES OF TOWNS AND CITIES.

With but one exception,—the town of Winchester,—every town in the state of over 2,000 inhabitants has a water system operated either by the town, fire precinct or by private companies. There are a number of towns with a population of over 1,500, with compact villages and important manufacturing industries within their limits, that have no supplies for drinking and domestic use or for protection from fire. On the other hand, many towns and villages with less than 1,500 inhabitants have installed water systems that furnish their residents excellent supplies of pure water at a very small expense to each householder. A large number of country towns are so sparsely settled that the individual supply is all that is required.

Of the 235 towns in the state, but 78 have water-supply systems; the remaining 157 towns rely upon springs and wells. The 78 towns have 88 supplies, of which 22 are owned by the town, 12 by a precinct of the town, and 54 by private individuals or corporations.

Forty-five thousand seven hundred sixty-seven families, representing 228,835 persons, or 55.6 per cent. of the population of the state, are supplied by these 88 systems. The supplies also furnish much water for manufacturing operations, fire protection, street sprinkling, public buildings, etc. Of the 88 supplies 33 are derived from springs, 25 from ponds, 15 from wells and 15 from streams. Several of the pond supplies are in reality impounded streams or low areas with abundant springs whose flowage is collected in an excavated basin. Twenty-one of the pond supplies have an area of 11,797.5 acres, and very generally have an uninhabited watershed. Lake Winnipesaukee, which is the source of the water supply of Laconia and Lakeport, is not included in the area of the ponds given above.

Forty-nine of the systems are operated by gravity alone, and 39 supplies are pumped to reservoirs and standpipes. The 30 reservoirs in the state have a capacity of 39,448,300 gallons, and the 9 standpipes a capacity of 2,325,700 gallons, a total capacity of 41,774,000 gallons.

There are * 768.1 miles of distributing and service pipe in use by the

*1902.

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various systems, the length per system varying from .5 to 100 miles. Forty-nine systems use cast-iron distributing pipes; 12, galvanized iron; 8, cement-lined pipe; 7, lead; 4, wrought iron; and 4, wood. The supply pipe in use is constructed as follows: 40 systems employ galvanized iron pipes; 21, cast iron; 14, lead; 5, wrought iron; and 3, cement-lined iron. One system of supply pipe is of wood.

From a study of these figures it appears that a majority of the systems use cast-iron pipe for distributing mains, and galvanized iron supply pipe. Cast-iron supply pipes are also extensively employed and several of the smaller systems still convey their water through lead distributing mains and supply pipes. In some instances trouble from lead poisoning is reported where lead pipes are used. From the fact that all our New Hampshire waters are soft and attack lead vigorously, all systems laid in the future should be some form of iron pipe, either plain cast iron, galvanized iron or cement-lined iron. There are still a few systems in use that carry water through wooden pipes. In one instance considerable trouble has been experienced with these pipes, which were clogged badly with vegetable growth and imparted a disagreeable odor and taste to the water.

With very few exceptions the water supplies are of excellent quality. Three small private supplies in the town of Amherst, which are distributed by lead pipe, contain very considerable amounts of lead; however, thus far no injurious results seem to have followed the use of the water. A small supply at Durham has been somewhat polluted by sewage in the past, and several cases of sickness are attributed to its use. The supply has been thoroughly cleaned out and the entrance of sewage prevented, so that at present the water is much improved in quality. While surrounding conditions are not of the best, no further trouble is to be anticipated from use of the water.

The system of the Hanover Water Company is supplied by an artificial pond 34 acres in extent. The water has never been of wholly satisfactory quality because of the excessive amount of organic matter present, which at times renders it very offensive to taste and smell. As the bottom of the pond becomes freed from vegetable matter, the quality of the water will improve until it eventually becomes similar in character to our natural pond waters.

The company has recently acquired control of all the farm land bordering on the reservoir, and has thus insured their supply against contamination by surface wash from cultivated lands.

The supply of the Exeter water works is obtained from an artificial pond some 20 acres in extent, and is similar in quality to the Hanover supply. The supply of the Goffstown fire precinct is derived from a reservoir fed

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by springs and a brook which drains from a swamp of about 100 acres. This brook water renders the supply excessively high in organic matter, especially during heavy rains or a wet season. It is undoubtedly true that the many cases of intestinal disturbances occurring during the summer months are due to the quality of this water. Steps are now being taken to keep out of the reservoir the waters draining from the swamp. When this is accomplished a very excellent supply will be afforded the precinct.

The supply of Antrim is a pond, the outlet to which has been dammed until it now flows a much larger area than formerly. Care was not taken to remove all vegetable mold from the surface of the ground which was flowed, and in consequence a very abnormal condition of the impounded water has occasionally resulted.

All our observations show that it is impossible to obtain an acceptable water supply by creating an artificial pond by damming and impounding a stream and flowing areas hitherto covered with vegetable growth, unless such areas are carefully stripped of all surface deposits, trees, stumps, roots and vegetable *debris*. If any vegetable growth is covered by the water it will slowly decay and impart to the supply a very decided color, odor and taste, and, as well, provide suitable food for innumerable organisms which may also have a deleterious effect on the quality of the water.

The supplies of Raymond, Lebanon, Franklin, Derry, Tilton and Northfield are discussed at length in special reports.

The condition of the water of our public supplies should be a source of gratification to all residents of the state. In purity, palatability and freedom from unpleasant color, odor, turbidity and sediment they are unexcelled.

If their present high standard of purity is maintained by constant supervision we shall not again experience such a deplorable epidemic of typhoid fever as that which swept Littleton in the winter of 1902. If, however, a scarcity of water prompts owners or superintendents of supplies to supplement their system by drawing upon sewage-polluted streams, the danger of epidemics will be ever present.

Following are reports by cities and towns alphabetically arranged. All results are given in parts per 100,000:

ACWORTH.—No public water supply. Families get their water from wells or from springs, and lead pipe is used as a rule. Water from eleven supplies was analyzed. Five supplies were of good quality, one was doubtful and five supplies were condemned as unsuitable for use, on account of the presence of large amounts of lead.

ALBANY.—There is no water supply other than wells and springs. The wells are mostly dug; a few are driven.

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ALEXANDRIA.—No public supply. Water is obtained from private wells and springs. One supply was examined which proved to be of good quality.

ALLENSTOWN (SUNCOOK).—The Suncook water works, established in 1877, is supplied from a pond of 25 acres and an average depth of 15 feet. The water runs through five miles of galvanized iron distributing mains, by gravity, to 60 families. Twenty per cent. of the population take this water.

Chemical Examination of Water from Suncook Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1903														
1331	July 14	None	Floc. veg.	Slight veg.	1.5	6.10	0.90	.0028	.0248	.0000	.0000	.15	.60	.....	..
1583	Oct. 12	None	None	Slight veg.	0.7	5.90	1.00	.0000	.0126	.0000	.0000	.17	.60	.....	..
	1904														
1932	May 8	None	None	Marked veg.	0.85	2.00	0.40	.0020	.0102	.0000	.0000	.12	.40	.....	..

Chemical Examination of Water from Baker and Dearborn Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1903														
1584	Oct. 12	Slight	V. slight	S. foul	0.2	3.60	1.90	.0020	.0026	.0000	.0000	.20	2.40	.....	..

Samples from 11 private supplies have been examined, of which five were of good quality, three were in doubtful condition and three were wholly unsuitable for use.

ALSTEAD.—No public supply. Four well supplies were examined, three of which were unsuitable for use.

ALTON.—No public supply. The Alton & Alton Bay Water-Works Company, established in 1892–'93, supplies about 100 families (90 per cent. of the population) with water from a spring, except in dry weather,

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when it is pumped from Lake Winnipesaukee to a reservoir of 150,000 gallons' capacity.

Chemical Examination of Water from Faucet of Supply of Alton & Alton Bay Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
782	1902 Sept. 6	None	Slight earthy	None	0.0	7.40	3.50	.0000	.0030	.0220	.0000	.27	3.10	.....	..
1337	1903 July 16	Slight	Consid. fine	Slight veg.	0.15	4.70	3.00	.0000	.0000	.0000	.0000	.15	2.60	.....	..
1936	1904 May 9	Slight	None	V. slight	0.0	5.50	3.00	.0010	.0012	.0050	.0000	.13	2.20	.....	..
2109	June 28	Slight	None	Slight earthy	0.0	7.40	3.80	.0000	.0018	.0000	.0000	.15	3.60	.....	..

Besides the above analysis of public waters one private well supply was examined and found to be of good quality.

Amherst.—No public supply. Several private supplies furnish spring water to some 40 families.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
422	1902 Mar. 3	None	None	None	0.0	.....	.....	.....	.....	.....	.....	....	1.20	.1600	..
423	Mar. 3	None	None	None	0.0	.....	.....	.....	.....	.....	.....	....	1.20	.1100	..
424	Mar. 3	None	None	None	0.0	.....	.....	.....	.....	.....	.....	....	1.40	.0265	..

The water from these supplies is of excellent quality, but dissolves lead readily. There are, however, no cases of lead poisoning recorded from use of the water.

Three private well supplies were also examined, all of which contained lead, although in other respects they were of good quality.

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ANDOVER.—No public supply. Andover Center is supplied with water from springs on the south side of Ragged Mountain.

Chemical Examination of Water Supplied Andover Center.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1902														
811	Oct. 9	None	Slight	None	0.0	7.00	2.90	.0000	.0000	.0000	.0003	.12	2.20	.....	..
855	Oct. 12	None	None	None	0.0	5.50	3.40	.0000	.0000	.0000	.0000	.12	2.30	.....	..

The water from 14 private supplies was examined, and all were of good quality except two spring supplies that contained much lead, and two wells badly polluted by sewage.

ANTRIM.—A water supply was installed by the town in 1893, the source being a pond of about 16 acres in area, and of an average depth of 16 feet.

Chemical Examination of Water from Public Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
95	July 30	None	Slight floc.	Strong veg.	0.4	3.40	.80	.0000	.0242	.0000	.0000	.11	....	.....	..
96	July 30	None	Much floc. veg.	De. veg. & musty	1.1	4.30	2.20	.0036	.0180	.0000	.0000	.12	....	.....	*
97	July 30	None	Slight	Decided musty	0.3	4.50	1.80	.0074	.0150	.0080	.0000	.12	....	.....	..
98	July 30	None	Slight	Decided aromat.	0.4	3.20	1.20	.0028	.0184	.0000	.0000	.13	....	.....	..
177	Sept. 20	None	Slight	Faint veg.	0.25	3.50	.60	.0028	.0180	.0000	.0000	.09	....	.....	..
178	Sept. 20	None	Slight	Faint veg.	0.25	4.40	.90	.0026	.0180	.0000	.0000	.09	....	.....	..
	1904														
1950	June 14	Slight	V. slight	Decided foul	0.15	2.60	.90	.0000	.0028	.0000	.0000	.05	.90	.....	..

Fifteen private supplies were examined, 10 of which were of good quality, four well supplies were of doubtful quality, and one was wholly unsuitable for use.

* Iron, .2360.

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ASHLAND.—The town operates a public water supply of excellent quality.

Chemical Examination of Water from Tap of Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
840	1902 Oct. 9	None	None	Veg.	0.25	6.50	1.00	.0000	.0064	.0000	.0000	.07	1.00	.....	..
1428	1903 Aug. 10	None	V. slight	Decided veg.	0.3	7.40	2.10	.0000	.0084	.0000	.0000	.075	1.60	.....	..
1943	1904 May 9	None	None	None	0.15	4.00	1.10	.0000	.0014	.0000	.0000	.150	1.10	....	*

Eight private supplies were examined, all of which were good, although the presence of lead in three spring waters rendered the supplies unsafe.

ATKINSON.—No public supply. Water is obtained from private wells. The two well supplies examined were of good quality.

AUBURN.—No public water supply. There is one private supply from which seven families are furnished, and one public watering trough for the town. But one supply was examined, and that was found to be very badly polluted.

BARNSTEAD.—No public supply. Of the three well waters examined two were pure and one very highly polluted.

BARRINGTON.—No public supply. The three private supplies examined were of good quality.

BARTLETT.—The public water supply, owned by the village precinct, was installed about the year 1888 by the Bartlett Water Company. The source is a stream having a watershed of two square miles, wooded land, no inhabitants.

* Colon B. present.

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Chemical Examination of Water from Tap of Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
880	1902 Oct. 21	None	None	V. slight veg.	0.1	4.90	.80	.0000	.0020	.0000	.0000	.07	.60	.....	..
1339	1903 July 15	None	None	Slight veg.	0.15	5.30	1.20	.0000	.0020	.0000	.0000	.10	0.90	.....	..
1991	1904 May 24	None	None	V. slight	0.05	5.40	1.90	.0000	.0014	.0000	.0000	.05	1.20	.....	..

Bath.—No public supply. The Bath Aqueduct Company operates a private system supplying a part of the village.

Chemical Examination of Water from Faucet of Bath Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
802	1902 Sept. 13	None	None	None	0.0	7.80	3.60	.0000	.0014	.0150	.0002	.15	3.60	.....	..

Of the two private supplies examined, one, a spring, was badly polluted; the other sample, from a brook, was of good quality, although unusually hard.

Bedford.—No public supply. Water is obtained wholly from private wells and aqueducts on the farms. The single supply examined was of good quality.

Belmont.—The Belmont water works, owned by the town, were installed in 1893. Water is obtained from wells, supplemented by a stream in dry seasons. There is a pumping station for use in dry seasons, by which water is pumped from a stream to the reservoir. There is also a private supply in the town.

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Chemical Examination of Water from Tap of Belmont Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
864	1902 Oct. 15	None	None	None	0.0	5.60	3.00	.0000	.0030	.0000	.0000	.12	3.00	.....	..
1327	1903 July 13	Slight	Slight	Decided foul	0.05	5.10	2.60	.0014	.0012	.0300	.0000	.25	1.20	.....	*
1328	July 13	None	None	V. slight	0.05	4.60	2.90	.0000	.0010	.0300	.0000	.20	1.50	.....	..
1329	July 13	None	None	None	0.05	4.30	2.00	.0000	.0000	.0150	.0000	.20	1.20	.....	..
1931	1904 May 7	None	None	Slight	0.0	2.50	.90	.0008	.0034	.0000	.0000	.125	.70	.....	..
2162	July 18	None	None	None	0.1	3.20	2.10	.0000	.0000	.0000	.0000	.075	1.90	.....	..

*Stream at pumping station. The quality of this water varies according to the use of the auxiliary stream supply.

The two private supplies examined were both of good quality.

Bennington.—No public supply. The Bennington Water Works Company, a private company, in 1900 installed a system supplied from springs, with a supplementary supply from a stream.

Chemical Examination of Water from a Faucet of the Bennington Water Works Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
751	1902 Aug. 27	None	V. slight	None	0.15	6.50	2.80	.0000	.0000	.0000	.0000	.10	1.50	.....	..
1334	1903 July 15	None	None	V. slight	0.1	3.70	2.30	.0000	.0030	.0000	.0000	.05	1.50	.....	..
341	July 16	None	None	Veg.	0.1	3.40	2.70	.0000	.0034	.0000	.0000	.05	2.00	.....	..
2262	1904 Aug. 9	Very marked	Much floc. red	None	0.6	6.10	1.70	.0000	.0034	.0050	.0000	.10	1.40	.....	*

*Colon B. present.

Water from five private supplies showed no pollution.

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BENTON.—No public supply. Water is obtained from springs, through lead pipes and logs and from wells.

BERLIN.—No public supply. There are two private supplies, owned and operated by one company,—the Berlin water works, built in 1892–'93, and the Cold Water Spring Company, installed in 1898. The source is a stream and springs. For a period of about six weeks each year the latter supply has to be supplemented by water pumped from Androscoggin River, above the city limits.

Chemical Examination of Water from Tap of Berlin Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
843	1902 Oct. 9	None	None	V. slight	0.75	6.50	1.40	.0000	.0112	.0000	.0000	.05	1.40	.....	..
1061	1903 Feb. 22	None	None	None	0.0	12.30	6.60	.0000	.0000	.0150	.0000	.07	2.00	.....	..
1326	July 13	None	None	V. slight	0.65	4.60	1.80	.0000	.0104	.0000	.0000	.05	0.70	.....	..
1491	Sept. 3	None	None	V. slight	0.4	3.60	1.40	.0000	.0044	.0000	.0000	.07	1.10	.....	..
1828	1904 Feb. 1	Slight	Much fine	V. slight	0.0	9.80	7.20	.0016	.0008	.0000	.0000	.10	5.80	.....	*
2179	July 20	None	None	None	0.0	12.40	9.30	.0000	.0000	.0200	.0000	.35	7.4	.....	..
2383	Sept. 16	None	Slight	None	1.10	8.00	2.60	.0006	.0166	.0700	.0000	.05	1.4	.....	†

* Artesian well of Berlin Water Company. † Stream recently added to system.

BETHLEHEM.—No public supply. The Crystal Springs Water Company, a private corporation organized in 1878, gets its supply from springs.

Chemical Examination of Water Supplied by the Crystal Springs Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
347	1902 Jan. 3	Slight	Slight veg. and min.	Earthy veg.	0.2	5.30	3.80	.0074	.0076	.0400	.0000	.06	1.60	.....	..

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Of the three well waters examined two were very pure and one was considerably polluted by seepage from sewage.

Boscawen.—Water is from the public supply, Penacook & Boscawen Water Precinct, constructed in 1892. The source is a pond of 340 acres; greatest depth, 36 feet; soil, largely gravel. The watershed is nearly seven square miles, both wooded and cleared. There are five or six houses on the shores of the pond.

Chemical Examination of Water from Faucet of Penacook & Boscawen Water Precinct at Penacook.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
789	1902 Sept. 9	None	None	Slight veg.	0.45	10.10	1.80	.0000	.0142	.0000	.0000	.11	1.50	.....	..
1944	1904 May 9	V. slight	Slight	Dec.veg.	0.3	4.20	1.70	.0000	.0032	.0000	.0000	.15	1.60	.....	..

The single well supply examined was of good quality.

Bow.—No public supply. Nine private supplies were examined, six of which were pure and three unsuitable for use.

Bradford.—No public supply. Of the 18 waters analyzed 10 were suitable for use, two were polluted by sewage, and six supplies contained so much lead as to be unfit for drinking.

Brentwood.—No public supply. The single sample of water analyzed was of good quality.

Bridgewater.—No public supply. Of the five samples of water analyzed four were pure and one badly polluted.

Bristol.—No public supply. The Bristol Aqueduct Company, a private corporation, have furnished water from Newfound Lake since about 1887.

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Chemical Examination of Water from a Faucet of the Bristol Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
747	1902 Aug. 26	None	V. Slight	Slight veg.	0.15	3.90	1.50	.0016	.0050	.0000	.0000	.06	.40	.....	..
1321	1903 July 13	V. Slight	Slight	Decided veg.	0.1	3.00	.90	.0028	.0044	.0000	.0000	.075	1.20	.....	..
1945	1904 May 5	Slight	None	Slight veg.	0.1	4.20	1.80	.0000	.0014	.0000	.0000	.075	1.50	.....	*

* Colon B present.

Seven supplies were examined, five of which were of good quality, one was very badly polluted, and one was condemned because of the presence of a large amount of lead in the water.

Brookfield.—No public supply. No water from this town has been analyzed.

Brookline.—No public supply.

Chemical Examination of Water from Public Fountain Supplied by a Well.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
327	1901 Dec. 10	None	None	Slight foul	0.0	9.30	7.00	.0000	.0076	.1250	.0002	.80	2.00	.....	..

Campton.—No public supply. Water from 27 supplies has been analyzed with the result that nine supplies appeared to be of good quality, six were of doubtful quality, and 12 supplies were unsuitable for drinking Six of the 12 bad supplies were polluted by lead.

Canaan.—No public supply. A private supply from Hart's Pond was introduced by the Crystal Lake Water Company in 1891.

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Chemical Examination of Water from Crystal Lake Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
868	1902 Oct. 16	Marked	Much floc.	Decided veg.	0.2	5.50	2.10	.0000	.0168	.0000	.0000	.07	2.00	.....	..

The water from 14 private supplies was analyzed and but three found to be of acceptable quality. Eight spring supplies contained so much lead that they were unsuitable for drinking, although in other respects they were of good quality, and two other spring supplies contained enough lead to render them of doubtful quality. One spring water contained 1.90 parts of iron per 100,000.

Candia.—No public supply. In 1894 or 1895 Mr. John A. Holt, shoe manufacturer at East Candia, introduced a water supply from a well bored one hundred feet deep.

Chemical Examination of Water from Supply of John A. Holt, East Candia.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
869	1902 Oct. 16	None	None	None	0.0	14.10	10.60	.0000	.0000	.4800	.0000	1.45	4.70	.....	..

Of the four private supplies examined three were unsuitable for use.

Canterbury.—There is no public or private water supply for the town. Most of the dwellings are supplied by individual wells. The two well supplies examined were of good quality.

Carroll. No public water supply.

Center Harbor. No public or private system of water works. The supply of the village is largely from springs, the water being conveyed

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through iron pipes. The Senter House pumps water from Lake Winnipiseogee for washing and bathroom purposes.

Water from nine private supplies has been examined, all of which proved to be of satisfactory quality.

CHARLESTOWN.—No public water supply. Of the six private supplies examined four were unsuitable for use because of sewage pollution.

Chemical Examination of Water from Connecticut River at Charlestown.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1940	1904 May 8	Slight.	Much fine	Slight veg.	0.3	4.40	2.63	.0012	.0068	.0000	.0000	.075	2.60	.....	..

CHATHAM.—No public supply. The water supply is mostly from dug wells, a few springs, and a few places are supplied from brooks and comes through lead pipe. Some iron pipe is used.

CHESTER.—No general public water supply. There are several watering places for horses and cattle supplied by springs, and the town owns a well at one of the schoolhouses.

Four of the eight private supplies examined were unsuitable for use, three because of sewage pollution and one because of the presence of much lead.

CHESTERFIELD.—No public supply. Water is obtained chiefly from springs and wells.

CHICHESTER.—No public supply. Seven private supplies were examined and three found to be badly polluted, two by sewage and one by lead.

CLAREMONT.—The town owns a water supply from a stream and a system of wells. The wells are 12 in number, dug 12 feet deep and covered with five feet of earth, so the depth of the wells is seven feet; they are three feet in diameter after being stoned. The amount of water is very abundant, and is pumped to the supply reservoir. Water from the stream is held in three reservoirs.

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Besides the public supply there are two private systems of water works in Claremont: one, the Tyler water works, was built in 1870, the source being springs. The springs are excavated all about a reservoir, into which the water runs. There are also springs in the bottom of the reservoir, which is about five acres in area.

The other private system, known as the Grannis water works, built about 1892 and owned and operated by Herman Holt, Esq., is also supplied by springs. There are two small reservoirs from which this water is taken: one some 30 feet in diameter, and about three feet deep on an average; the other some 75 feet in diameter, and of an average depth of about three feet.

Chemical Examination of Water from Town Supply Reservoir.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
797	1902 Sept. 11	None	None	Slight veg.	0.15	6.30	2.30	.0000	.0056	.0000	.0000	.12	1.90	.....	..
1323	1903 July 13	None	None	Slight musty	0.2	4.30	2.20	.0000	.0056	.0000	.0000	1.07	1.90	.....	..
1942	1904 May 9	Slight	None	None	0.1	5.60	4.40	.0000	.0030	.0000	.0000	.07	2.60	.....	..

Chemical Examination of Water from Tyler Aqueduct.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
895	1902 Oct. 29	None	None	None	0.0	8.70	5.80	.0000	.0022	.0150	.0000	.09	3.10	V. slt.	..

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*Chemical Examination of Water from Faucet of Hotel, Supplied by Grannis Water Works.**

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
	1901													
236	Oct. 28	None	None	None	0.0	7.10	4.40	.0028	.0044	.0200	.0003	.07	....	.....
237	Oct. 28	None	None	None	0.0	9.20	5.30	.0028	.0054	.0200	.0003	.07	....	.....
241	Oct. 31	None	None	None	0.0	7.80	5.70	.0010	.0040	.0200	.0004	.07	2.40	.....

* Sample 237 was from Farmington faucet.

In addition to the analyses of the public supplies four samples were examined from private sources. Three of these supplies were pure and one was badly polluted by sewage.

Clarksville.—No public supply. Every dwelling in town is furnished with spring or well water.

Colebrook.—This town does not own a public water supply. There are two private systems, the J. E. Lombard water works, and a system now being put in by Moon & Co., under contract with the town, to be used for fire and domestic purposes. The system is to be accepted by underwriters, fire wardens and selectmen. The source of these supplies is a stream and springs, and the water flows about four miles through iron pipes, both main and service. Three fourths of the water-shed is cleared, and one fourth wooded. There are many private wells within the radius reached by these supplies.

Chemical Examination of Water from Several Sources of Supply for Town Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
	1904													
2378	Sept.15	Marked	Slight	None	0.4	10.40	3.90	.0000	.0044	.0050	.0000	.050	5.50	.....
2379	Sept.15	None	V. much floc. veg.	None	1.1	11.00	2.80	.0000	.0001	.0000	.0001	.05	4.40	.....
2380	Sept.15	None	None	None	0.0	10.00	5.20	.0000	.0000	.0300	.0000	.07	2.70	....
2381	Sept.15	None	V. much floc. veg.	None	0.5	11.70	5.00	.0000	.0072	.0000	.0000	0.5	4.80	.....

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Water from five private supplies was also examined, four of which were of good quality.

COLUMBIA.—No public supply.

CONCORD.—The Concord water works, owned and operated by the city, were installed in 1871–'72; extended to Penacook and St. Paul's School in 1882; high service extension in 1891; high service extended to Penacook in 1904. The source of the supply is Penacook Lake, with an area at high water of 337 acres; greatest area of good depth running from 10 to 75 feet; very little shallow water; bottom gravelly. The watershed, about three and one-eighth square miles, is partly wooded and partly cleared. Outside of cottagers, a canvass showed seventeen inhabitants to the square mile. The shores, excepting Penacook Park, which is well policed, are now rarely frequented by picnic parties. A few cottages, occupied during the summer, have been built on the shores, but they are under the sanitary supervision of the city health officer. The State Board of Health has also established rules and regulations for the protection of the purity of this body of water. The city owns and controls four-fifths of the shore..

Chemical Analysis of Merrimack River at Concord.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
1958	1904 May 16	Slight	Much floc.	Slight veg.	0.35	3.00	1.70	.0000	.0066	.0050	.0000	.15	1.20	.....

The Merrimack River does not constitute any part of the water supply for the city of Concord. The latter is taken wholly from Penacook Lake.

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Chemical Examination of Water from City Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
1	May 22	V. slight	Slight	Decided veg.	0.0	2.90	1.80	.0015	.0163	.0048	.0000	.13	....	.....	..
2	May 22	V. slight	Slight	Faint veg.	0.0	.....	.....	.0013	.0122	.0048	.0000	.12	....	.....	..
3	May 22	Slight	Consid.	Decided veg.	0.0	.....	.....	.0013	.0149	.0048	.0000	.12	....	.....	..
4	May 23	Slight	Consid.	Decided veg.	0.0	2.50	1.20	.0014	.0137	.0050	.0000	.12	....	.....	..
107	Aug. 6	None	None	Decided veg.	0.12	3.30	.90	.0000	.0154	.0000	.0000	.11	....	.....	..
113	Aug. 12	Slight	Slight floc.	Decided veg.	0.1	4.00	1.40	.0014	.0156	.0000	.0000	.10	....	.....	..
	1902														
357	Jan. 11	None	None	Veg.	0.1	3.20	1.20	.0030	.0138	.0000	.0000	.14	1.10	.....	..
398	Feb. 10	V. slight	V. slight	Veg.	0.12	3.70	1.90	.0044	.0136	.0000	.0000	.12	.90	.....	..
591	June 13	V. slight	V. slight	Decided veg.	0.15	5.30	1.50	.0016	.0146	.0000	.0000	.11	.70	.....	..
592	June 13	V. slight	Slight	Decided veg.	0.1	6.20	1.60	.0000	.0124	.0000	.0000	.11	.70	.....	..
593	June 13	V. slight	V. slight	Slight	0.15	5.50	2.10	.0006	.0072	.0000	.0000	.11	.70	.....	..
594	June 13	V. slight	V. slight	Veg.	0.15	6.10	1.70	.0006	.0126	.0000	.0000	.11	.70	.....	..
595	June 13	V. slight	V. slight	Veg.	0.15	6.70	1.70	.0006	.0108	.0000	.0000	.12	.70	.....	..
596	June 13	None	None	Veg.	0.15	6.20	1.60	.0000	.0112	.0000	.0000	.11	.70	.....	..
775	Sept. 4	None	None	Decided veg.	0.1	4.30	1.50	.0000	.0102	.0000	.0000	.12	1.50	.....	..
13	Nov. 11	None	None	Slight veg.	0.05	5.80	1.60	.0000	.0094	.0000	.0000	.14	1.55	.....	..
	1903														
966	Jan. 1	None	None	Slight veg.	0.12	5.40	1.60	.0000	.0086	.0000	.0000	.17	1.50	.....	..
983	Jan. 12	None	None	Slight veg.	0.05	.....	.....	.....	.....	.0000	.0000	....	....	.....	*
1078	Mar. 7	None	None	V. slight	0.05	.....	.....	.0006	.0056	.0050	.0000	.15	1.80	.....	..
1153	Apr. 21	Slight	Fine	Decided veg.	0.05	2.90	1.40	.0000	.0030	.0000	.0000	.15	1.40	.....	..
1269	June 19	None	None	Slight veg.	0.05	.....	....	.....	.....	.....	.....	....	....	.027	..
	1904														
1924	May 6	Slight	Slight	Slight veg.	0.05	3.10	1.60	.0006	.0054	.0000	.0000	.15	1.50	.....	..
2371	Sept. 15	None	None	Slight veg.	0.05	3.80	0.90	.0000	.0044	.0000	.0000	.13	1.50	.....	†

* Lead present in traces only. † B. Coli. present.

The water from 39 other supplies was examined. Seventeen supplies were of good quality, 18 were bad, and four were doubtful.

Conway.—No public supply. The Conway Aqueduct Company, under local management, supplies the village with water from a system of natural springs about two and a half miles from its center. Nineteen private

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supplies were examined, and 10 were found to be suitable for use, and the other eight were badly polluted by sewage.

CORNISH.—No public water supply. All the families of this town depend upon wells, or water taken from springs through lead pipe, each family having a separate supply. Six private waters were examined, and five were of satisfactory quality. The other supply was contaminated by lead.

CROYDON.—No public supply. One private supply is from a spring, the water being brought one half mile through lead pipe, from which five families are furnished. Most of the water is from private wells. Three well supplies were examined, all of which were of good quality.

DALTON.—No public supply. Water is obtained from individual springs. The single supply examined was of good quality.

DANBURY.—No public or private system of water works. Eight spring supplies were analyzed, and four were pure, two contained so much lead as to be unfit for use, and two contained enough lead to render them of doubtful quality.

DANVILLE.—No public supply. The water supply of Danville is, in nearly every case, from a well near the house or underneath it. The water from four wells was examined, with the result that one supply was found to be pure, one unsuitable for use, and two to contain so much seepage from sewage that their quality was doubtful.

DEERFIELD.—No public supply. An analysis of five well waters showed considerable past pollution in each case, although but one supply was so contaminated as to be unfit for drinking.

DEERING.—No public water supply. The single spring supply examined was of good quality.

DERRY.—No public supply. In 1890 Boston contractors built the Derry water works, consisting of about 40 wells driven to a depth of 50 feet. The water is pumped to a standpipe of 180,000 gallons' capacity.

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Chemical Examination of Water from Faucet of Derry Water Works Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1902														
794	Sept. 4	None	Slight	V. slight	0.0	6.40	4.80	.0000	.0012	.0120	.0000	.60	3.10	....	..
	1903														
1372	July 24	None	None	Slight musty	0.0	7.00	3.60	.0000	.0010	.1500	.0000	.65	2.30	.....	..
1532	Sept. 2	None	V. slight	None	0.1	12.40	6.80	.0000	.0038	.0700	.0000	.55	2.40	.....	..
	1904														
1946	Mar. 10	None	None	Slight veg.	0.05	6.90	4.90	.0000	.0014	.1500	.0000	.65	2.60	.....	..

Six private well supplies were examined, three of which were badly polluted by sewage.

Dorchester.—No public supply. The water used in town is from private wells and springs. The single spring supply examined contained lead in sufficient quantity to render the water of doubtful quality.

Dover.—A public water supply was installed by the city of Dover in 1888. The area of the pond from which the supply is taken is, when full, 78¾ acres; when drawn down six feet, 69½ acres. There are no measurable streams of water flowing into the pond, it being fed mainly from underground sources. The water is pumped to a reservoir of a capacity of 2,085,452 gallons when at a height of 14 feet.

Chemical Analysis of City Water Supply of Dover.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
246	Nov. 4	None	None	Faint	0.0	5.50	2.40	.0010	.0080	.0000	.0000	.19	....	.....	..
	1903														
985	July 13	None	None	Slight fishy	0.1	7.00	2.40	.0000	.0036	.0000	.0000	.30	1.80	.....	..
1356	July 20	Slight	Floc. veg.	V. decid. veg.	0.1	6.20	2.50	.0010	.0146	.0000	.0000	.25	1.10	.....	..
1422	Aug. 10	Marked	Much floc.	Pungent veg.	0.1	7.30	2.00	.0000	.0084	.0000	.0000	.37	1.60	.....	..
	1904														
2031	June 9	Marked	Much floc. veg.	Slight earthy	0.1	4.50	2.90	.0008	.0034	.0000	.0000	.30	2.40	.....	..
2035	June 9	Marked	V. much red	None	0.05	5.50	4.10	.0006	.0042	.0000	.0000	.30	2.80	.....	..
2037	June 9	Slight	Slight	Slight	0.05	5.20	2.80	.0006	.0038	.0000	.0000	.30	2.60	.....	..
2150	July 12	Slight	Much floc.	Decided musty	0.05	4.10	2.30	.0000	.0092	.0000	.0000	.28	1.60	.....	*
2151	July 12	Marked	Consid.	V. m'rk'd ar'matic	0.8	4.30	2.70	.0010	.0074	.0000	.0000	.25	2.60	.....	*

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* B. Coli. present.

Chemical Analysis of Auxiliary Supplies.—Brook in Hussey Field.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1420	1903 Aug. 10	Marked	V. much floc.	Veg.	.04	6.20	3.00	.0054	.0056	.0300	.0000	.38	2.80	.....	..
1994	1904 May 27	Slight	V. much red floc.	V. slight	.03	4.60	3.20	.0022	.0040	.0100	.0000	.43	1.60	.....	*

* B. Coli. present.

Easterly Springs.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1421	1903 Aug. 10	None	None	Mucky	0.0	5.80	2.90	.0022	.0024	.0350	.0000	.28	2.85	.....	..

Brook on Left of Upper Well.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1993	1904 May 27	Slight	Much white floc.	Slight arom'tic	0.35	5.20	3.00	.0018	.0038	.0200	.0000	.48	1.60	.....	..

Water from six private supplies was examined and four were found to be suitable for use. Two were badly polluted by sewage.

Dublin.—This town has no water system, the supply being mostly from individual wells and springs, and from streams and ponds through private pipes, iron or lead. Of private supplies examined, seven samples were unsuitable for use, three were of doubtful quality, and seven were pure. The pure samples were spring waters, and four of the six bad waters were spring waters containing much lead, but otherwise of good quality.

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DUMMER.—No public supply. Water is obtained chiefly from springs, wells and aqueducts.

DUNBARTON.—No public supply. Water is obtained from springs and wells. Five well supplies were examined, all of which were suitable for use.

DURHAM.—No public supply. A private supply, owned by C. H. Pettee, furnishes water to a number of families.

Chemical Examination of Water from Faucet of Supply of C. H. Pettee.

Number.	Date of operation.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
784	1902 Sept. 8	None	None	None	0.0	15.20	9.50	.0012	.0028	.3500	.0003	.58	5.50	.....	..
1360	1903 July 21	Marked	Fine floc.	V. slight	0.15	12.80	6.70	.0000	.0000	.0500	.0001	.65	4.50	.....	..
1981	1904 May 24	Slight	None	None	0.0	15.20	6.90	.0000	.0016	.2200	.0000	.60	4.70	.....	..

One other sample was examined which was very heavily polluted by sewage.

EAST KINGSTON.—No public water supply. There is one watering trough, from which five families are supplied.

EASTON.—No public supply. Water is obtained from individual wells and springs.

EATON.—No public water supply. Two private well supplies were examined, one of which was wholly unfit for use because of the presence of much lead. The other supply was of good quality. Three spring waters all contained lead in large quantities.

EFFINGHAM.—No public supply.

ELLSWORTH.—No public supply. Water is obtained wholly from private springs and wells.

ENFIELD.—The Enfield Village Fire District Water Works, built in 1902 and 1903, by Arthur W. Stone of Hartford, Vt., is owned by the precinct. The source of the supply is a pond of 21 acres in area, and an average depth of about eight feet, fed by springs. The watershed is about 2,000 acres, principally cleared land, with only two families living near.

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The water flows by gravity through four miles of iron pipe. Service pipes are lead. From one fourth to one third of the population are supplied from this system, with additional connections being made each week.

There are also two private systems of water works in town: The Mascoma Aqueduct Co., whose plant was built in 1884. This supply is from a spring two feet in depth, which supplies about 1,000 gallons daily. This is a gravity system, with one mile of lead main pipe, and also lead service pipes. Ten families are supplied with this water, but some of them also have the town water.

The other private system was built by the Enfield Aqueduct Co. in 1854, the source being a well 16 feet deep. This, also, is a gravity system with three fourths of a mile of cement-lined lead pipe for a main, and lead service pipes. The average daily consumption from this system is 1,320 gallons, by forty families, but the town water is also supplied to some of these patrons.

Chemical Analysis of Water from the Enfield Village Fire District Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
2075	1904 June 20	V. slight	Slight	Decided veg.	0.45	.....	.....	.....	.....	.0000	.0000	.15	4.10	.....	..

Epping.—No water supply other than individual wells and springs. Water from six private supplies was examined and the samples were of good quality. The other three were well waters badly polluted by seepage from sewage.

Epsom.—No public water supply operated by town or private company. Water from 27 private supplies has been analyzed. Twelve supplies were of good quality; seven were badly polluted and eight supplies were rendered of doubtful quality because of the presence of seepage or lead.

Errol.—No public supply.

Exeter.—No public supply. The Exeter Water Works, owned by a private company, were installed in 1886. The source of the supply is an artificial pond fed by springs and brook.

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Chemical Examination of Water from Faucet of Supply of Exeter Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
749	1902 Aug. 26	V. slight	Decided red floc.	Marked veg.	0.5	7.80	2.80	.0000	.0202	.0000	.0000	.37	2.80	.....	..
1358	1903 July 20	None	Floc.	V. slight	0.4	8.20	1.50	.0000	.0096	.0000	.0000	.30	2.20	.....	..
1959	1904 May 16	Marked	Much fine	Slight veg.	0.5	6.70	3.60	.0000	.0144	.0050	.0000	.32	3.20	.....	..
2209	July 26	Marked	V. much red. floc.	Slight aromat.	0.5	7.50	4.70	.0006	.0108	.0050	.0000	.42	4.70	.....	..

Nine private well supplies were examined, all of which were badly polluted by sewage with one exception.

FARMINGTON.—The town owns and operates a water supply from two springs twelve feet deep. The water is distributed from a reservoir.

Chemical Examination of Water from Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
858	1902 Oct. 10	None	Slight	V. slight	0.0	5.90	3.00	.0000	.0020	.0200	.0000	.45	3.00	.....	..

Five well supplies were examined, two of which were badly polluted by sewage; two were doubtful because of an unexplained high chlorine, and one was of good quality.

FITZWILLIAM.—No public supply. The water used throughout the town comes from wells or from springs, many families in the village having running water from springs the entire year. Water from seven private well supplies was analyzed, four of which were so heavily polluted by sewage as to be wholly unfit for use.

FRANCESTOWN.—No public supply. There is a private spring supply from which 24 families take.

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Chemical Examination of Water from Spring Reservoir.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
783	1902 Sept. 6	None	None	V. slight	0.0	8.50	4.00	.0000	.0000	.3000	.0000	.10	2.70	.....	..

The single supply examined contained so much lead that it was classed as of doubtful quality.

Franconia.—No public supply. A private company, known as the Franconia Water Supply Company, in 1888 or 1889, introduced a water supply from a spring a mile and a half distant.

Chemical Examination of Water of the Franconia Water Supply Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
387	1902 Feb. 1	None	Floc.	Earthy veg.	0.2	5.90	1.30	.0000	.0086	.0210	.0000	.10	1.30	.....	..
1357	1903 July 19	None	None	None	1.0	6.70	2.00	.0000	.0000	.0200	.0000	.05	1.80	.....	..

One well water was examined and found to be of very good quality.

Franklin.—The Franklin Water Works, owned by the city, were built in 1891. The source is springs, which are about six feet deep, dug and bricked. There is a covered reservoir about 20 feet deep. During certain portions of the year the supply from the springs is insufficient, and it has been the custom to draw directly from the river. An extension of the system is necessary if danger from use of the polluted river water is to be avoided.

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Chemical Examination of Water from Faucets of Franklin Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
78	1901 July 24	None	None	None	0.0	3.90	2.70	.0036	.0052	.0200	.0000	.14	....	.0100	..
337	Dec. 20	None	None	S. veg.	0.05	3.40	2.10	.0008	.0034	.0400	.0000	.18	.8	.....	..
338	Dec. 20	None	None	S. veg.	0.05	4.00	2.40	.0014	.0050	.0220	.0000	.16	.8	.....	*
339	Dec. 20	None	None	S. veg.	0.05	4.40	1.40	.0026	.0054	.0760	.0000	.80	.8	.....	†
804	1902 Sept.15	None	None	None	0.0	6.50	3.30	.0000	.0016	.0200	.0000	.27	2.0	.....	..
849	Oct. 8	None	None	None	0.0	.....	.....	.....	.....	.0200	.0000	....	....	.000	..
870	Oct. 15	None	None	None	0.0	.....	.....	.....	.....	.0300	.0000	.17	....	.0870	..
986	1903 Jan. 14	None	None	S. veg.	0.0	9.10	3.20	.0000	.0010	.0200	.0000	.15	1.20	.000	..
1166	Apr. 27	None	None	None	0.0	3.60	1.60	.0000	.0000	.0100	.0000	.15	1.60	.0560	..
1288	July 1	None	None	S. veg.	0.0	6.20	2.20	.0000	.0016	.0200	.0000	.15	1.80	T.	..
1351	July 20	None	None	None	0.0	4.40	2.60	.0000	.0014	.0000	.0000	.20	1.40	.....	..
1599	Oct. 15	None	None	V. slight	0.0	5.10	1.20	.0000	.0040	.0300	.0000	.15	1.10	.0400	..
1699	Nov. 24	None	None	Aromat.	0.0	3.50	2.00	.0006	.0070	.0000	.0000	.20	1.20	.0080	..
1700	Nov. 24	None	None	Slight aromat.	0.0	3.80	2.60	.0000	.0040	.0000	.0000	.70	1.20	.....	*a*
1701	Nov. 25	None	Consid. floc.	None	0.0	10.20	7.90	.0000	.0020	.3000	.0000	.70	3.20	.....	*a*
1702	Nov. 24	None	None	None	0.05	4.20	2.70	.0010	.0060	.0000	.0000	.20	1.80	.0130	..
1724	Dec. 15	None	None	S. veg.	0.0	4.90	6.00	.0000	.0012	.0400	.0001	.30	1.90	.....	..
1725	Dec. 15	Marked	Much floc. veg.	V.S. veg.	0.05	3.40	1.60	.0020	.0070	.0100	.0000	.15	1.50	.....	..
1754	Dec. 22	V. slight	None	S. veg.	0.1	3.80	2.50	.0000	.0014	.0000	.0000	.25	1.60	.0090	..
1812	1904 Jan. 25	Slight	Slight	S. earthy	0.0	2.60	1.40	.0020	.0048	.0000	.0000	.05	1.00	.....	*b*
1815	Jan. 25	None	None	None	0.0	2.60	1.60	.0014	.0022	.0000	.0000	.05	1.10	.....	*c*
1842	Feb. 18	Slight	Floc. veg.	None	0.0	2.60	1.80	.0008	.0032	.0000	.0000	.15	1.40	.....	*d*
1843	Feb. 18	None	V. slight	None	0.0	2.90	2.10	.0006	.0014	.0000	.0000	.20	1.20	.....	†*e*
1844	Feb. 18	None	S. veg.	None	0.0	3.00	2.00	.0006	.0016	.0050	.0000	.15	1.80	.....	*
1879	Mar. 29	Slight	V. slight	S. veg.	0.1	4.80	2.10	.0006	.0022	.0800	.0000	.15	1.60	.....	..
1922	May 5	None	None	S. veg.	0.05	5.20	3.00	.0024	.0026	.0250	.0000	.20	1.85	.....	..
2093	June 27	Slight	None	V. slight	0.0	2.50	.90	.0010	.0024	.0000	.0000	.20	1.00	.....	..

*Sample taken from tap at pumping station; †Sample taken from reservoir of sulfit spring; *a*. Auxiliary supply; *b*. Bacteria per c. c. (river water), 1460; *c*. Bacteria per c. c (do), 1740; *d*. Bacteria per c. c. (do), 1290; *e*. *B. Coli* present.

Note.—At the present time, Oct., 1904, *B. Coli* is present in waters taken from spring reservoir and river.

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In addition to the examinations of water from the public supply and auxiliary streams, a large number of private supplies were analyzed. Of 57 analyses, 27 supplies were pure, 18 were polluted, and 12 were of doubtful quality. Of the 11 spring waters unsuitable for use 10 were so condemned because of the large quantities of lead present in the water. In many instances lead has been found in the city water. Its presence is due to the use of lead service pipes, which should be replaced by some other form of pipe less liable to attack by the water.

FREEDOM.—No public supply. Some three fourths of the families in town are supplied with water from springs through iron and lead pipes. A few wells are still used. Six samples of water from private supplies were analyzed and all proved to be of good quality.

FREMONT.—No public or private water system. The single spring supply analyzed was of good quality.

GILFORD.—No public supply. Water is obtained from individual wells and springs.

GILMANTON.—No public water supply. Five well supplies were examined, three of which were so badly polluted by sewage as to be unsuitable for use.

GILSUM.—No public supplies. Several spring supplies are utilized by several families, although wells are chiefly depended upon for water. Four well supplies were examined and three were found to be of good quality. The fourth well water contained so much lead that it was unfit for use. One spring supply contained a large amount of lead and was condemned.

GOFFSTOWN.—The present system was built in 1891 by the Goffstown Fire Precinct, Goffstown Village. The reservoir from which the water supply comes is situated between the Uncanoonuc Mountains and is surrounded by woodland. The reservoir is fed by springs in the bottom of the reservoir; by a brook, fed by springs flowing from the northeastern slope of the north mountain; and from a swamp flowing into the brook near the mouth of the reservoir. The water supplied is of high color, and contains very much organic matter. There have been epidemics of bowel troubles at various times, which have been attributed to the condition of the water. The peculiar quality of the water is attributed to the fact that in the spring and during the heavy rains in the fall and at other times when it is wet or rainy the water flows from the swamp of 100 acres into the reservoir. Until the precinct controls the flow of water

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from the swamp or some measures are taken to protect the reservoir from the influx of water containing such great amounts of vegetable matter the water will be of poor quality.

Chemical Examination of Water from Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
201	1901. Oct. 10	None	Floc. veg.	Decided veg.	1.40	5.60	2.20	.0042	.0276	.0000	.0002	.17	....	.....	..
795	1902. Sept. 11	None	None	Decided veg.	1.90	8.70	2.00	.0028	.0234	.0000	.0002	.11	2.00	.....	..
1388	1903. July 29	Slight	Floc. veg.	Decided veg.	1.1	8.00	1.10	.0014	.0202	.0000	.0000	.16	0.90	.....	..
1962	1904. May 17	None	None	V. slight veg.	0.9	4.20	1.80	.0000	.0080	.0000	.0000	.18	1.70	.....	..

Twelve private supplies were examined, and six were condemned because of the presence of much lead.

Gorham.—No public supply. The Alpine Aqueduct Company, organized in 1873, furnishes water to 160 families, one half the population, from 19 springs, three to seven feet deep, stoned and covered.

Chemical Examination of Water from a Faucet of the Alpine Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
799	1902. Sept. 11	None	None	None	0.0	7.40	4.80	.0000	.0000	.0000	.0000	.10	1.90	.....	..
1352	1903. July 18	None	None	None	0.0	5.80	1.20	.0000	.0014	.0000	.0000	.05	1.10	.....	..
1957	1904. May 15	None	None	V. slight	0.0	4.80	3.70	.0014	.0030	.0000	.0000	.07	2.00	.....	..

Goshen.—No public supply. Water is obtained from wells, eight to 20 feet deep, through loam, gravel, clay and sand. The single well supply examined was polluted by sewage and was unsuitable for use.

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GRAFTON.—No public supply. All the water is obtained from individual wells and springs. But two supplies were examined, one of which was good and the other highly polluted by sewage.

GRANTHAM.—No public supply. Water is obtained entirely from private wells and springs. Six private supplies were examined, two of which were pure, two polluted, and two of doubtful quality.

GREENFIELD.—There is no public water supply. Water is obtained from wells dug four or five feet deep, in sandy soil, and flows by gravity one eighth of a mile through lead pipe. In two instances two or three families have shared the expense and have the same supply. Of the eight well supplies examined four were of good quality, three were doubtful, and one was so badly polluted by sewage as to be wholly unfit for use.

GREENLAND.—No public supply. Six private supplies were examined, of which three well waters were so badly polluted by sewage as to be wholly unfit for drinking, one drilled well furnished water of good quality, and the two spring supplies were pure.

GREENVILLE.—The town owns and operates a small water supply in the form of an artesian well 425 feet deep, ending in solid rock, and most of the distance below 125 feet in solid rock. The water is pumped to a brick reservoir of 20,000 gallons' capacity.

Chemical Examination of Water from Faucet of Artesian Well Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
753	1902. Aug. 27	None	None	None	0.0	12.40	8.70	.0000	.0000	.0200	.0000	.12	3.90	.....

Nine private well supplies were examined, six of which were unsuitable for use because of sewage pollution or the presence of much lead.

GROTON.—No public supply. Water is obtained from individual springs and wells. The two well supplies examined were of good quality.

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HAMPSTEAD.—No public supply. Seven of the 10 well supplies analyzed were polluted by sewage and unfit for use; two wells were in good condition and one was of doubtful quality.

HAMPTON.—The water supply of this town is from individual wells and springs. Of the seven well supplies examined five were in a satisfactory condition and two were of doubtful quality.

HAMPTON FALLS.—No public water supply. Two private supplies were analyzed; one, a spring, was of good quality; the other, a well, was badly polluted.

HANCOCK.—No public supply. Water is obtained from springs and wells. Water for the village is brought from wells a few feet deep, dug on a hill, thus obtaining an almost unlimited supply. The whole village supply is taken by individuals from this source. Eight private supplies were analyzed, and five waters proved to be pure; one was badly polluted and two contained enough lead to make them of doubtful quality.

HANOVER.—The Hanover Water-Works, installed in 1893, is an impounded water in a large artificial pond. The bed of the pond was a fertile valley, which was not cleared of vegetation before impounding the water. The water has always been colored, rich in dissolved vegetable matter, with some little taste and odor, though usually not offensive. It will probably be a long time before the supply approaches the conditions of a natural pond water. The Hanover Aqueduct Association, a private corporation, furnishes a water that is used largely, though not exclusively, for drinking purposes. It is a normal spring water, the wells being four or five in number and dug to a depth of 20 feet, and yielding 4,000 gallons per day. There are very few individual wells in this locality.

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Chemical Examination of Water from Supply of the Hanover Water-Works Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1893.														
....	Oct. 29	Marked	Much	.....	Faint yel. brown	8.10	4.00	.0170	.0240	.0000	.0000	....	2.90	.....	*a*
....	Nov. 27	Marked	.....	.....		7.20	2.68	.0080	.0170	.0000	.0000	....	2.70	.....	*b*
....	Dec. 29	Faint	.....	.....		6.08	3.16	.0088	.0178	.0000	.0000	.10	2.70	.....	*c*
	1894.														
....	Jan. 26	None	None	.....	0.7	8.50	.....	.0088	.0224	.0000	.0000	.26	....	.....	*d*
....	Feb. 8	None	None	Foul	0.7	8.50	4.60	.0010	.0132	.0000	.0000	.20	4.10	.....	*e*
....	Mar. 8	None	None	Slight	0.3	10.00	5.70	.....	.....	.....	.....	.40	1.92	.....	*f*
....	Apr. 10	Slight	.....	.....	0.3	4.88	1.80	.....	.....	.0400	.0000	.16	....	.....	..
....	Dec. 27	.....	.....	.....	0.7	.....	.....	.0003	.0250	.0200	.0000	.05	2.99	.....	*g*
	1896.														
....	Mar. 20	.....	.....	.....	0.5	5.28	2.64	.0066	.0180	.0000	.0000	.10	1.43	.....	..
	1902.														
798	Sept. 11	V. slight	Slight veg.	V. decid. & earthy	0.55	8.80	3.30	.0020	.0230	.0000	.0000	.09	2.20	.....	..
	1903.														
1353	July 20	Marked	V. much floc.	V. mark. veg.	0.5	7.80	2.20	.0010	.0240	.0000	.0000	.10	2.20	.....	..
1384	July 29	Marked	Floc. veg.	Decayed veg.	0.2	7.70	2.50	.0010	.0214	.0000	.0000	.07	2.00	.....	..
1385	July 27	Marked	Floc. veg.	Decayed veg.	0.2	8.10	2.40	.0010	.0216	.0000	.0000	.07	2.10	.....	..
	1904.														
1838	Feb. 16	Slight	Fine floc.	V. slight	0.6	8.60	3.20	.0208	.0184	.0000	.0000	.10	2.60	.....	..
1839	Feb. 16	Marked	Consid. fine	Slight veg.	0.6	8.20	3.80	.0218	.0184	.0000	.0000	.10	2.70	.....	..
1840	Feb. 16	Slight	Consid. floc.	Veg.	0.6	...	.....	.0218	.0184	.0000	.0000	.10	2.70	.....	..
1865	Mar. 9	Slight	Slight	Marked veg.	0.4	10.10	2.00	.0104	.0126	.0000	.0000	.10	2.20	.....	*h*
1866	Mar. 9	Marked	Slight	Marked veg.	0.5	9.60	2.50	.0236	.0152	.0000	.0000	.15	2.20	.....	..
1886	Apr. 4	V. slight	None	Marked veg.	0.3	4.90	2.40	.0000	.0036	.0000	.0000	.10	2.35	.....	*i*
1887	Apr. 4	V. slight	None	Marked veg.	0.3	6.20	2.80	.0006	.0052	.0000	.0000	.10	2.40	.....	*j*

a Reservoir filling.
b Reservoir half full.
c Heavy thaw.
d Heavy thaw.
e Offensive.
f Heavy thaw.
g Sample from pipes.
h Filtered through sand filter.
i Filtered through sand filter, No. 1.
j Filtered through sand filter, No. 2.

We are indebted to Prof. Edwin J. Bartlett of Dartmouth College for the first nine analyses, which were made by him while the supply was being introduced and the year following, when the water was in a bad condition.

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The experiments now being carried on in the attempt to make the water of more satisfactory quality promise to be successful. [See report elsewhere in this volume.] Results of analyses Nos. 1886 and 1887 show a very decided improvement in the quality of the water after filtration.

HARRISVILLE.—No public water supply. Thirty-four private well and spring supplies were analyzed. Twelve supplies were good, eight were doubtful and 14 were unfit for use. Of the supplies condemned, seven were heavily polluted by lead.

HART'S LOCATION.—No public supply.

HAVERHILL.—No public supply. The Haverhill Aqueduct Company, a stock company, built a system of water works for the town more than 50 years ago, the source of the supply being a spring. Water flows by gravity through lead main and service pipes. The village of Woodsville in this town has a public system. For analyses of water see Woodsville

Chemical Examination of Water from Faucets of Haverhill Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
771	1902 Sept. 3	None	None	None	0.0	6.10	3.90	.0000	.0000	.0300	.0000	.065	3.60	.....	..
1407	1903 Aug. 5	None	None	Slight	0.0	5.00	2.80	.0000	.0000	.0000	.0000	.05	2.70	.....	..
1960	1904 May 16	None	Consid. fine	Slight veg.	0.0	4.10	3.10	.0056	.0032	.0150	.0000	.08	2.70	.0700	..
1997	May 30	None	None	None	0.0	5.10	3.30	.0000	.0032	.0000	.0000	.10	2.60	.....	..

Ten private supplies were analyzed and seven well supplies were condemned because of the large amount of lead present. Three spring supplies were of good quality.

HEBRON.—No public supply. Water is obtained from individual wells and springs. Two well supplies examined were of doubtful quality. The single spring water analyzed was pure.

HENNIKER.—No public supply. Water is from the private supplies of the Henniker Spring Water Company, installed in 1884, and the Dow System, installed in 1874. The sources are springs and wells.

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Chemical Examination of Water from a Faucet of the Henniker Spring Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
745	1902 Aug. 26	None	None	None	0.0	5.90	4.50	.0000	.0000	.0100	.0000	.07	2.60	.....	..

HILL.—No public supply. There are two private supplies in town. One owned by George A. Sumner, constructed in 1890, is taken from a stream about a mile long at the dam. The pond thus formed is about one half an acre in area and 10 feet deep. In 1893 a supply from a spring was introduced by Mr. F. R. Woodward. This spring flows about 50 gallons per minute; soil, sand and clay.

Chemical Examination of Water from a Faucet in Hill, Supplied by George A. Sumner's Water Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
786	1902 Sept. 9	V. slight	V. slight	Slight veg.	0.25	8.70	1.50	.0000	.0036	.0000	.0000	.10	1.40	.....	..
1207	1903 May 24	V. slight	V. slight	Slight veg.	0.20	4.60	3.00	.0000	.0018	.0000	.0000	.10	1.40	.....	..

Chemical Examination of Water from a Faucet in Hill, Supplied by F. R. Woodward's Water Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
761	1902 Sept. 2	None	None	None	0.0	6.00	2.50	.0000	.0028	.0700	.0000	.22	1.80	.....	..
1208	1903 May 24	None	None	None	0.0	4.40	2.70	.0008	.0076	.1000	.0001	.25	2.60	.....	..

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Six other samples of water from private supplies were analyzed and of that number four spring supplies were either bad or of doubtful quality because of the presence of considerable lead. The two well supplies examined were both of doubtful quality because of sewage pollution and organic filth.

HILLSBOROUGH.—The Hillsborough Bridge Village Fire Precinct owns a water supply, instituted in the autumn of 1886. The source is a pond of about 500 square acres; average depth about 15 feet; bottom, sand and ledge, with natural deposit. The water flows by gravity to intermediate reservoir of 500,000 gallons' capacity.

Chemical Examination of Water from Faucet of the Hillsborough Bridge Village Fire Precinct.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
746	1902 Aug. 20	None	None	None	0.2	3.70	1.30	.0000	.0060	.0120	.0000	.12	1.20	.....	..
1374	1903 Aug. 27	Slight	Floc. veg.	V. slight	0.2	5.10	1.10	.0000	.0080	.0000	.0000	.08	0.90	.....	..
1781	1904 Jan. 4	Slight	Slight	Slight	0.15	3.10	2.00	.0000	.0072	.0000	.0000	.12	1.50	.....	..
1967	May 17	V. slight	Slight	None	0.05	3.60	1.90	.0000	.0080	.0000	.0000	.05	1.60	.....	..

The three private supplies examined were all of poor quality; one because of lead, the others because of sewage pollution.

HINSDALE.—No public supply. Every family has a private well. Eight private supplies have been analyzed and one sample was very badly polluted by sewage. Three other well supplies have received much sewage pollution in the past and are of doubtful quality.

HOLDERNESS.—Nearly all the water used in town is from wells and springs. Three waters from private supplies were analyzed. One well water contained over 2.5 parts of zinc per 100,000. The other two supplies were of good quality.

HOLLIS.—No public or private water supplies.

HOOKSETT.—No public supply. There are two private supplies. One owned by Mrs. M. C. Towle, is from a brook which has been dammed.

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The watershed extends for about half a mile on each bank. The other supply, owned by Henry C. Carbee, is from a pond supplied by springs.

*Chemical Examination of Water from Various Sources in Hooksett.**

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
865	1902 Oct. 16	V. slight	Floc.	Veg.	0.9	4.60	1.40	.0000	.0114	.0000	.0000	.17	1.80	.....	..
866	Oct. 16	None	None	Slight veg.	0.0	3.40	1.20	.0000	.0042	.0000	.0000	.17	.90	.....	..

*Sample No. 865 is from supply of Mrs. M. C. Towle; No. 866 from that of Mr. Henry C. Carbee.

Four well supplies were analyzed, three of which proved to be of good quality. One well had evidently received much sewage in the past, though, at present, the supply is of fair quality.

Hopkinton.—No public supply. There is a private supply, introduced by the Hopkinton Village Aqueduct Association, from springs and wells.

Chemical Examination of Water from Supply of Hopkinton Village Aqueduct Association.

Number.	Date of collection.	Appearance				Resid ue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
876	1902 Oct. 16	None	None	None	0.0	8.90	4.20	.0000	.0000	.0300	.0000	.15	1.60	.....	.
2146	1904 July 10	None	None	None	0.0	3.60	1.40	.0014	.0008	.0500	.0000	.15	1.40	.....	.

Water from seven private supplies has been examined, and all were suitable for use. One sample contained much iron, but was otherwise of very good quality.

Hudson.—No public supply. The Hudson water works, owned by a private company, were built in 1892. The source of the supply is a well 20 feet deep and 22 feet wide, dug through loam and gravel. The water is pumped to a standpipe 12 feet in diameter and 60 feet high.

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Chemical Examination of Water from Well Supplying Town of Hudson.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
69	1901 July 16	None	Slight floc.	None	0.0	6.00	3.70	.0014	.0026	.1000	.0000	.40	....	.....	..

Water from twenty private supplies was analyzed. Eight wells were condemned as unfit for use; 10 well waters and one spring water were of good quality.

JACKSON.—No public water supply. Most of the farmers and boarding-houses are supplied from individual springs on their premises.

JAFFREY.—The town instituted a system of water works in 1902, the source being a pond in Rindge having an area of 40 acres, an average depth of 20 feet, with hardpan bottom. The water flows by gravity through nine miles of 12-inch, cast-iron distributing mains; service-pipes, 6-inch cast iron.

Chemical Examination of Water from Bullet Pond, Rindge.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
186	1901 Oct. 1	None	Slight veg.	Decided veg.	0.12	2.80	1.30	.0016	.0166	.0000	.0000	.16	....	.....	..
232	Oct. 20	None	None	Veg.	0.12	.....	.....	.0016	.0180	.0000	.0000	.09	....	.....	..
349	1902 Jan. 5	None	None	Veg.	0.2	2.30	1.10	.0032	.0172	.0000	.0000	.08	.40	.....	..
348	Jan. 5	None	None	Veg.	0.2	2.50	1.10	.0032	.0162	.0000	.0000	.09	.40	.....	..
1373	1903 July 27	Slight	None	Slight musty	0.1	5.10	1.90	.0016	.0058	.0000	.0000	.08	1.40	.....	..
1686	Nov. 23	Slight	V. S. fine	V. dec. veg.	0.1	4.00	1.10	.0000	.0144	.0300	.0000	.15	1.20	.....	..
1687	Nov. 23	Slight	V. S. fine	Dec. veg.	0.2	4.20	2.10	.0014	.0128	.0200	.0000	.15	1.15	.....	..
1758	Dec. 22	Slight	V. slight	V. mark. veg.	0.1	4.20	2.40	.0006	.0062	.0060	.0000	.25	2.30	.....	..
1759	Dec. 22	Slight	Slight	V. mark. veg.	0.1	3.90	2.10	.0000	.0074	.0000	.0000	.20	2.30	.....	..
1955	1904 May 16	Consid.	Much fine	V. aromatic.	0.2	4.20	2.20	.0000	.0110	.0000	.0000	.18	2.00	.....	..

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Seven private well supplies were analyzed; four were good, one was of doubtful quality, and 10 were badly polluted and unfit for use.

JEFFERSON.—No public supply. The Waumbek Hotel Company have a fine supply system of their own from natural springs and spring brooks.

*Chemical Examination of Water Supply of the Waumbek Hotel Company.**

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
184	1901 Sept. 30	None	None	None	0.0	3.80	1.80	.0016	.0042	.0480	.0000	.03	.. .	.... ..

* Sample from spring east of main hotel.

Two spring waters and one well water were analyzed, and all were found to be somewhat polluted and of doubtful quality.

KEENE.—In 1870 the City of Keene installed a public water supply from two ponds, one 50 acres and the other 110 acres in area; Sylvan Lake having an average depth of 20 feet, and Echo Lake, 12 feet. There are also several auxiliary supplies.

Chemical Examination of Water from Keene.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
27	1901. June 24	V. slight	Slight floc.	Decided veg.	0.2	2.80	1.00	.0000	.0169	.0000	.0000	.18	....	.....	*
455	1902. Mar. 27	Slight	Slight	Veg.	0.23	1.60	.70	.0010	.0122	.0150	.0000	.07	.70	.....	†
456	Mar. 27	Slight	Slight	Veg.	0.23	2.00	1.00	.0020	.0076	.0000	.0000	.07	.70	.....	‡
457	Mar. 27	V. slight	Slight	Veg.	0.32	3.10	.80	.0000	.0052	.0000	.0000	.07	.60	.....	§
458	Mar. 27	Marked	Slight	Veg.	0.12	2.10	.80	.0010	.0078	.0000	.0000	.11	.60	.....	¶
1172	1903. May 3	Slight	Floc. fine	Veg.	0.2	2.80	1.50	.0014	.0198	.0000	.0000	.15	0.90	.....	**
1173	May 4	Slight	Fine floc.	Veg.	0.15	5.00	2.00	.0014	.0158	.0000	.0000	.15	0.90	.....	..
1174	May 4	Slight	Fine floc.	Veg.	0.1	3.00	0.60	.0020	.0202	.0000	.0000	.17	0.60	.....	††
1175	May 4	Slight	Much fine floc.	Veg.	0.15	4.90	1.60	.0000	.0060	.0000	.0000	.10	0.40	.....	..

* Sample from Goose Pond.
† Sample from intercepting reservoir.
‡ Sample from stream proposed as an additional supply.
§ Sample from small stream flowing through an alder swamp.
¶ Small stream, part of proposed supply.
** Sample from Woodward Pond.
†† Sample from Sylvan Lake.

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Seven private supplies were examined, three of which were badly polluted.

KENSINGTON.—There is no water supply in town other than individual wells and springs. The two well waters analyzed were of good quality.

KINGSTON.—There is no public water supply. The people draw their individual supplies from private wells, dug from 10 to 25 feet through light, dry, sandy soil. The single well water examined was free from pollution.

LACONIA.—No public supply. The Laconia Water Company is a corporation established in 1885. The supply is pumped from Lake Winnepesaukee to a reservoir of 2,750,000 gallons' capacity.

Chemical Examination of Water Supply of Laconia and Lakeport.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1902.														
532	May 19	None	V. slight	Slight veg.	0.1	2.80	.90	.0000	.0014	.0000	.0000	.13	.60	.....	..
822	Sept. 22	None	None	V. slight	0.1	4.00	1.10	.0000	.0062	.0000	.0000	.11	.60	.....	..
	1904.														
2141	July 11	None	None	None	0.4	7.70	4.90	.0022	.0098	.0450	.0008	.20	2.20	.....	..

In 1903 a water supply was introduced at the State School for Feeble Minded, the source being Opeechee Lake. Several analyses were made of this water, both before and after the installation of the supply.

Chemical Examination of Water from Opeechee Lake, Water Supply for the State School for the Feeble Minded.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1903.														
1221	June 10	None	Slight fine	V. slight	0.05	3.90	0.60	.0000	.0080	.0000	.0000	.15	1.50	.....	..
1222	June 10	None	Slight fine	V. slight	0.05	6.20	1.60	.0000	.0074	.0000	.0000	.15	1.50	.....	..
	1904.														
2000	May 31	Slight	Slight fine	Slight foul	0.05	3.40	1.40	.0000	.0084	.0050	.0000	.15	1.10	.....	..

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Five well supplies were analyzed, two of which were good, one of doubtful quality, and two so badly polluted as to be unfit for drinking.

LANCASTER.—The Lancaster Water Company works were installed in 1891, and transferred to the precinct in 1894. The source of the supply is a mountain stream, wooded land, no inhabitants.

Chemical Examination from Faucet of Precinct Water-Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
813	1902. Sept. 19	None	None	V. slight	0.1	3.40	1.50	.0000	.0012	.0200	.0000	.05	1.50	.....	..
1408	1903. Aug. 4	None	None	None	0.1	4.80	1.60	.0000	.0034	.1100	.0000	.10	1.60	.....	..
1965	1904. May 17	Slight	Consid. fine.	Slight veg.	0.25	3.60	1.90	.0000	.0150	.0450	.0000	.05	1.40	.....	..

LANDAFF.—No public supply. The town is supplied with water from springs and wells. There are several public watering places on different roads.

LANGDON.—No public or private system of water-works. The people obtain water from private wells and springs.

LEBANON.—The water supply is owned by the Fire Precinct, and was installed in 1897. At first the water was taken directly from a stream flowing from Mascoma Lake, but at present from wells, 63 x 30 x 15 feet, supplied by 900 feet loose-jointed pipe, fed by filtered water from the river. "Mascoma Lake receives water from Mascoma River, on which are sawmills and factories. At the head of the lake a small stream enters which receives sewage along its course. The lake also receives sewage from the Shaker buildings and from the village of Enfield."

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Chemical Examination of Water from Reservoir Well.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901.														
33	June 27	None	Slight floc.	Slight veg.	0.8	4.60	2.80	.0000	.0115	.0000	.0000	.22	....	.....	..
34	June 27	None	Min. matter.	V. slight	0.0	7.60	5.30	.0000	.0000	.0100	.0000	.31	....	.....	..
53	July 6	Marked	Much min.	None	0.0	6.70	4.10	.0073	.0098	.0000	.0000	.33	....	.....	..
54	July 6	None	Min.	None	0.0	6.00	3.40	.0028	.0100	.0900	.....	3.51	....	.....	..
	1902.														
614	June 25	Slight	V. slight	Aromat. veg.	0.2	7.00	2.60	.0006	.0082	.0330	.0000	.12	1.80	.....	..
	1903.														
1144	Apr. 19	None	None	Decided veg.	0.0	5.00	3.60	.0000	.0190	.0000	.0000	.12	1.60	.....	*
1297	July 6	Slight	Floc.	None	0.15	5.10	2.70	.0000	.0072	.0000	.0000	.10	2.00	.....	§
1298	July 6	Slight	Floc. veg.	Slight veg.	0.32	5.30	1.70	.0000	.0080	.0000	.0000	.06	1.50	.....	**
	1904.														
1968	May 18	None	None	V. slight	0.1	4.60	2.80	.0000	.0044	.0000	.0000	.10	2.30	.....	..
2251	Aug. 8	Slight	Much floc. red	Slight veg.	0.5	5.80	2.70	.0014	.0024	.0000	.0000	.30	2.40	.....	†
2293	Aug. 22	None	V. slight	V. slight	0.05	4.00	2.00	.0000	.0020	.0000	.0000	.10	1.80	.....	††
2294	Aug. 22	None	None	V. slight	0.05	3.90	1.90	.0000	.0070	.0000	.0000	.10	1.60	.....	††

* Tap from Mascoma River, filtered through Duplex Filter.
§ From storage well.
** From Mascoma River.
† From dead end of pipe; *B. Coli* present.
†† *B. Coli* present.

In addition to the chemical analyses reported above many bacteriological examinations have been made for the purpose of demonstrating the efficiency of the earth through which the water passes from the river to the storage well in removing sewage bacteria. (For further discussion of the quality of this water see elsewhere in this report.) Four private supplies were examined, all of which were somewhat polluted and of doubtful quality.

LEE.—There is no water supply other than wells and springs.

LEMPSTER.—No public supply, water being obtained from individual wells.

LINCOLN.—No public supply. In 1892 J. H. Henry & Sons introduced a system of water-works from a stream.

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Chemical Examination of Water from Faucet of Supply of J. H. Henry & Sons.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
762	1902. Sept. 1	None	V. slight	V. slight veg.	0.1	4.80	1.90	.0000	.0044	.0150	.0000	.05	.30	.....	..
1377	1903. July 25	None	None	V. slight	0.05	4.10	1.30	.0000	.0030	.0000	.0000	.04	0.60	.....	..
1956	1904. May 14	None	Slight	None	0.2	2.90	1.30	.0000	.0054	.0000	.0000	.05	0 90	.....	..

Lisbon.—No public supply. The Lisbon Water Works, owned by a private company and installed in 1887, is supplied from a pond fed by springs. The area of the pond is 100 acres; the bottom is gravelly.

Chemical Examination of Water from the Reservoir of the Lisbon Water Works Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
796	1902 Sept. 9	Slight	Consid. floc.	V. slight	0.0	6.90	2.60	.0000	.0066	.0000	.0000	.08	2.30	.....	..
1387	1903 Sept.29	Slight	None	Decided veg.	0.1	6.70	2.80	.0000	.0120	.0000	.0000	.05	2.70	.....	..
1985	1904 May 24	Slight	Slight fine	Slight musty	0.25	6.10	2.70	.0000	.0090	.0000	.0000	.05	1.90	.....	..

Litchfield.—No public supply.

Littleton.*—No public supply. The Littleton Water and Light Company operates a system of water works, instituted in 1880, from which about 300 families are supplied. The water is taken from gallery wells along the bank of the Ammonoosuc River, which receives sewage from towns above, and is pumped to a reservoir of half a million gallons' capacity.

*** Also see special report on the "Pollution of Ammonoosuc River" in Vol. 16, Report of State Board of Health.**

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In the winter of 1903 the water supply from the gallery wells ran short, and for a time water was pumped directly from the Ammonoosuc River. In consequence of this action a very severe typhoid epidemic broke out and public sentiment was aroused against the water system. The town bought the privileges of the Littleton Water and Light Company and introduced a new supply, which is described below.

Chemical Examination of Water Supplied by the Littleton Water and Light Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
7	May 26	Slight	Much floc.	Slight veg.	0.4	4.10	1.90	.0018	.0155	.0000	.0000	.06	....	.....	..
8	May 26	V. slight	V. much veg.	Slight veg.	0.3	3.80	1.60	.0016	.0067	.0000	.0000	.08	....	.....	..
9	May 26	V. slight	V. much veg.	V. slight veg.	0.25	4.70	1.60	.0012	.0073	.0000	.0000	.07	....	.....	..
88	July 26	None	Much floc. veg.	Faint veg.	0.2	4.00	2.20	.0032	.0130	.0050	.0000	.12	....	.....	..
89	July 26	None	Much floc. veg.	Faint veg.	0.2	3.90	2.60	.0032	.0114	.0050	.0000	.12	2.40	.....	..
151	Sept. 6	None	Much floc.	Decided veg.	0.12	2.10	1.00	.0008	.0082	.0090	.0000	.10	....	.....	..
185	Sept. 30	None	Floc. veg.	Faint veg.	0.2	3.70	1.90	.0026	.0096	.0000	.0000	.10	....	.....	..
	1902														
444	Mar. 13	Slight	Floc. veg.	Veg.	0.3	9.10	2.20	.0018	.0076	.0100	.0000	.04	1.10	.....	..
573	June 5	V. slight	Slight	Decided veg.	0.25	7.30	2.00	.0000	.0052	.0180	.0000	.09	1.90	.....	..
686	Aug. 4	Slight	Slight floc.	V. decid. veg.	0.5	4.90	1.40	.0000	.0098	.0000	.0000	.07	1.40	.....	..
687	Aug. 4	Marked	Floc.	Veg.	0.5	4.00	1.50	.0000	.0066	.0000	.0000	.07	1.20	.....	..
965	Dec. 31	None	None	Slight veg.	0.2	4.40	0.70	.0000	.0056	.0220	.0000	.07	0.6	.....	..
	1903														
972	Jan. 5	None	None	V. slight veg.	0.1	.....	.....	.0000	.0028	.0000	.0000	.10	1.10	.....	**
973	Jan. 5	None	None	V. slight veg.	0.1	.....	.....	.0000	.0054	.0000	.0000	.09	1.10	.....	**
1082	Mar. 9	V. slight	None	Slight veg.	0.18	6.70	2.40	.0000	.0022	.0040	.0000	.10	2.40	.....	..

** *B. Coli* present.

Littleton's New Water Supply.—Since the last report of this board the town of Littleton has bought the property of the Littleton Light and Water Company, has abandoned the use of Ammonoosuc River as a water supply, and has gone some 10½ miles from the village to a new supply, the north branch of Gale River, the intake of which is at the base of Mt. Garfield. The main pipe is 16 inches in diameter for

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a short distance from the intake; 12 inches for the next five miles; and 10 inches for the remainder of the distance.*

Chemical Analysis of Water from Littleton's New Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1148	1903 Apr. 17	None	Slight floc. veg.	None	0.2	2.90	1.00	.0000	.0026	.0200	.0000	.07	0.90	.....	*
1149	Apr. 17	None	Slight floc. veg.	None	0.15	2.00	0.90	.0000	.0016	.0200	.0000	.05	0.90	.....	†
1706	Dec. 2	None	None	None	0.05	3.30	2.10	.0006	.0012	.0400	.0000	.07	0.50	.....	..
1707	Dec. 1	None	None	None	0.05	3.10	2.00	.0020	.0012	.0400	.0000	.07	0.50	.....	..
1779	1904 Jan. 1	None	V. slight	V. slight veg.	0.05	4.00	2.60	.0000	.0010	.0400	.0000	.15	0.90	.....	..

*South branch of Gale River.
† North branch of Gale River.

During the epidemic of typhoid fever in the winter of 1902–'03 nearly all the private well and spring supplies near the village of Littleton were analyzed. After the epidemic had passed these private supplies were depended upon for water pending the installation of the new system. Twenty-six well waters were analyzed; 11 were of good quality; six were receiving sewage pollution and were of doubtful quality; and nine wells were condemned as unfit for use. Thirteen spring waters proved to be of good quality, and eight were so contaminated by seepage as to be unsuitable for drinking.

Livermore.—No public supply.

Londonderry.—No public supply.

Loudon.—No public supply. All the water is obtained from wells and springs. The single well supply analyzed proved to be unfit for use.

Lyman.—No public supply. Water is obtained from wells and from springs, through lead pipe or logs.

Lyme.—In 1838 the Lyme Aqueduct Company inaugurated a system of water works, the source being springs.

*See special report elsewhere under "The Littleton Epidemic of Typhoid Fever."

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Chemical Examination of Water from Supply of Lyme Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
772	1902 Sept. 3	None	V. slight	None	0.0	8.40	4.70	.0000	.0018	.0250	.0000	.08	4.70	.....	..
1723	1903 Dec. 10	Slight	Slight fine	None	0.0	5.40	3.60	.0000	.0022	.0150	.0000	.07	3.10	.0280	..
1975	1904 May 23	None	V. slight	Slight foul	0.0	5.50	4.60	.0020	.0020	.0000	.0000	.12	4.50	.....	..

Two private spring supplies and one well water were of good quality.

LYNDEBOROUGH.—No public water service; simply individual wells and springs. The water from five private supplies was analyzed, and two well supplies were condemned because of sewage pollution; two spring supplies contained lead in considerable quantities and one spring water was of excellent quality.

MADBURY.—No public supply; individual wells.

MADISON.—No public supply. The Silver Lake Reservoir Company, in 1886, introduced a supply from a natural spring. The water has never been analyzed at this Laboratory.

MANCHESTER.—A water supply was instituted by the city in 1873, was added to in 1886, and supplemented by a high service in 1894. The source is Lake Massabesic, having an area of 2,500 acres, an average depth of 20 feet, and a bottom partly rocky and partly muddy. It has approximately 40 miles of watershed, wooded and cleared about equally. Some sawdust enters the lake. The water is pumped to a reservoir of 15,000,000 gallons' capacity, and an average depth of 20 feet. There are 100 miles of distributing mains, iron; service pipes are iron, lead lined. The average daily consumption is 3,000,000 gallons. Twelve thousand two hundred families, nine tenths of the population, are consumers of this water. There are not many individual wells within the radius of this supply.

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Chemical Examination of Water from Lake Massabesic.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
369	1902 Jan. 21	None	None	Decided veg.	0.8	5.70	1.20	.0054	.0204	.0000	.0000	.12	.70	.....	*
370	Jan. 21	None	None	Decided veg.	0.7	5.50	.70	.0044	.0228	.0000	.0000	.16	.70	.....	†
371	Jan. 21	None	None	Decided veg.	0.7	5.70	1.00	.0020	.0188	.0000	.0000	.21	.70	.....	‡
372	Jan. 21	None	None	Decided veg.	1.0	9.10	1.60	.0012	.0156	.0000	.0000	.17	.70	.....	§
727	Aug. 22	None	Floc. veg.	Veg.	0.35	7.40	1.30	.0000	.0106	.0000	.0000	.17	1.20	.....	¶
1074	1903 Mar. 5	Slight	Fine floc. veg.	Decided veg.	0.1	3.80	1.00	.0010	.0132	.0040	.0060	.16	0.0	.....	‡
1075	Mar. 5	Slight	Fine floc. veg.	Decided veg.	0.7	4.90	1.10	.0000	.0066	.0040	.0000	.11	1.00	.....	§
1076	Mar. 5	Slight	Fine floc. veg.	V. decid. veg.	0.75	6.50	1.30	.0000	.0066	.0040	.0000	.15	1.20	.....	†
1077	Mar. 5	Slight	Fine floc. veg.	Decided veg.	0.65	4.80	1.60	.0000	.0066	.0040	.0000	.17	1.40	.....	††

* Sample taken at high service intake.
† Sample taken at Deer Neck Bridge, Auburn.
‡ Sample taken halfway between Severance Beach and Battery Point.
§ Sample taken at mouth of Sucker Brook.
¶ Sample taken at tap in Board of Health Building from low service reservoir.
†† Sample taken in front of Judge Emery's house in Auburn.

Hanover Spring, situated in Hanover Common, has until recently supplied the public fountains along Elm Street. The spring is never-failing and originally furnished a very pure water. At present it is surrounded by a densely populated district, and each year is becoming more polluted. It is a peculiar fact that the last three examinations of water from the spring, made at intervals of one year, have shown a marked difference in composition, and that the chlorine content of water at the spring is lower than at the tap in the City Hall. This unusual condition can only be explained by supposing that there is some forgotten spring feeding the supply through a branch pipe. The Board of Health of Manchester has recently condemned this supply, and obtained the consent of the State Board of Health to close it permanently.

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Chemical Examination of Water from Hanover Spring, Hanover Common.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
128	Aug. 21	None	None	None	0.0	25.30	18.30	.0012	.0044	1.2000	.0000	3.72	8.20	.....	..
125	Aug. 19	None	None	None	0.0	25.60	20.30	.0020	.0022	1.2000	.0000	4.05	7.45	.....	*
	1902														
728	Aug. 22	None	None	None	0.0	22.60	13.40	.0000	.0000	.6000	.0007	2.90	7.20	.....	..
726	Aug. 22	None	None	None	0.0	28.00	17.70	.0006	.0038	.8000	.0000	3.45	6.80	.....	*
	1904														
2272	Aug. 15	None	None	Dec. foul	0.0	21.40	15.60	.0006	.0008	.9000	.0003	2.70	9.00	.....	..
2271	Aug. 15	None	None	None	0.0	25.20	19.50	.0000	.0000	.1000	.0001	3.25	8.80	.....	*

* Samples taken from tap at city Hall.

Chemical Analysis of Water from Various Supplies of State Industrial School, Manchester.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1902														
498	May 5	None	None	None	0.0	9.70	5.60	.0026	.0034	.0800	.0000	.40	2.00	.....	*
499	May 5	Slight	None	Slight veg.	0.0	7.60	4.50	.0000	.0026	.2500	.0000	.70	1.95	.....	†
500	May 5	Marked	None	Marked stable	0.3	7.80	2.10	.0036	.0148	.0700	.0000	.40	1.60	.....	‡
	1904														
1909	Apr. 27	None	Slight	V. slight	0.05	7.10	5.60	.0052	.0096	.0800	.0003	.80	1.10	.....	§
1910	Apr. 27	None	None	Slight	0.0	6.90	3.90	.0040	.0042	.1000	.0002	.60	3.20	.....	§§
1911	Apr. 27	None	None	Slight	0.05	5.10	2.50	.0000	.0052	.0050	.0000	.25	2.20	.....	††
1912	Apr. 27	None	Slight	Slight	0.0	9.30	6.60	.0014	.0026	.4000	.0003	.70	3.10	.....	**
1913	Apr. 27	None	Slight	Slight	0.0	6.10	2.90	.0026	.0032	.0500	.0004	.35	2.40	.....	¶

* Bricked up spring west of pond.
† Tank in top of main building fed by spring well near Union street.
‡ Pond north of horse barn, while pond was turbid after heavy rains.
§ South horse spring.
§§ North cow spring.
†† Big north well.
** Big south well.
¶ Spring near red barn; *B. Coli* present.

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In addition to these analyses water from six private supplies was examined and every supply but one was found to be unsuitable for drinking because of lead or sewage pollution.

MARLBOROUGH.—No public supply. Water is taken from wells and springs through lead pipe. Water from seventeen private supplies has been analyzed and all but five were found so be suitable for use.

MARLOW.—No public supply. Families are supplied almost wholly from wells; a few have private springs. The one well supply analyzed was of good quality.

MASON.—There is no public water supply in the town. Wells and springs are the main source of supply, and are all owned by individual parties. Two waters were analyzed and both found to be suitable for use.

MEREDITH.—The Meredith Fire District owns and operates a water supply that was installed in 1894, the source being springs. The water flows by gravity from a reservoir on a hill.

Chemical Examination of Water from a Faucet of the Supply of the Meredith Fire District.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
774	1902 Sept. 3	None	None	Dec.veg.	0.2	6.10	1.60	.0020	.0074	.0000	.0000	.12	1.60	.....	..
1296	1903 July 7	Slight	V. slight	Marked veg.	0.1	5.00	2.30	.0000	.0038	.0000	.0000	.10	1.60	.....	..
1399	Aug. 3	Marked	Much fine	V. dec. veg.	0.25	6.60	1.90	.0040	.0158	.0300	.0000	.15	1.90	.....	..
1971	1904 May 23	None	None	S. veg.	0.25	3.10	1.70	.0022	.0030	.0000	.000(	.15	1.60	.....	..

Eleven well supplies were analyzed, eight of which were of good quality. Three well waters were very badly polluted by sewage. The one private spring supply examined was pure.

MERRIMACK.—No public or private system of water works. The people of the town, with the exception of a few tenements, derive their water supply from wells. The tenements mentioned are supplied from a spring. Water from nine well supplies was examined. Five supplies were of good quality, three were badly polluted by sewage, and one was of doubtful quality.

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MIDDLETON.—No public supply. This is strictly a farming town, and each place has its individual well.

MILAN.—No public water supply. Water is obtained from individual wells. Two well supplies were examined: one contained considerable lead and the other was very foul. Both were unsuitable for drinking.

MILFORD.—The public water works of Milford were built in 1890 by John T. Langford, and purchased by the town in 1891. There are three collecting wells, two of them about 35 feet in diameter and one 20 feet deep; one somewhat smaller is fed by driven pipes. Soil, gravel with clay bottom. The water is pumped to a stand pipe of 250,000 gallons capacity.

Chemical Examination of Water from Faucet of Milford Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
152	Sept. 9	None	None	None	0.2	5.10	3.20	.0012	.0074	.0120	.0000	.23	....	.....	..
	1902														
828	Sept.22	None	None	None	0.1	6.40	3.60	.0000	.0030	.0000	.0000	.13	3.40	.....	..
827	Sept.22	V. slight	Slight	Slight	0.3	8.00	2.60	.0022	.0066	.0000	.0008	.18	2.60	.....	..
	1903														
1014	Jan. 28	Slight	None	Veg.	0.1	13.60	4.00	.0000	.0008	.0000	.0000	.17	3.30	.....	..
1400	Aug. 3	V. slight	None	None	0.1	5.60	2.80	.0000	.0040	.0000	.0000	.15	2.40	.....	..
	1904														
1980	May 23	None	None	S. earthy	0.15	5.90	1.40	.0000	.0018	.0000	.0000	.10	1.20	.....	*
2080	June21	Slight	V. marked floc. red	V. slight	0.3	6.60	4.60	.0006	.0010	.0000	.0000	.22	4.70	.....	..
2147	July 12	None	V. slight	V. slight	0.3	4.40	1.10	.0026	0044	.0000	.0000	.20	.90	.....	**
2148	July 12	Marked	V. slight	None	0.1	6.60	2.20	.0014	.0034	.0000	.0000	.17	2.30	.....	§
2206	July 26	V. slight	V. slight	V. slight	0.3	3.70	2.40	.0000	.0060	.0000	.0000	.12	1.80	.....	†
2208	July 26	None	None	None	0.0	4.90	3.50	.0006	.0000	.0200	.0000	.17	1.10	.....	**
2368	Sept.14	Slight	Slight	V. slight	0.15	4.90	2.90	.0000	.0064	.0000	.0000	.20	1.90	.....	‡
2369	Sept.14	Slight	Slight	None	0.3	6.10	2.50	.0000	.0070	.0000	.0000	.15	2.70	.....	†
2370	Sept.15	None	Consid. floc.	Decided earthy	0.05	5.20	2.40	.0010	.0024	.0000	.0000	.20	2.60	.....	§

* B. Coli present.
** Well No. 1.
† Well No. 3.
§ Well No. 2.
‡ Stand pipe.

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Water from 33 private supplies was analyzed. Eight well supplies were condemned because of sewage pollution, 11 were of good quality, and nine were receiving so much seepage that they were classed as of doubtful quality. Three spring supplies contained much lead, and one spring was very dirty and somewhat polluted. A cistern water was of abnormal composition and was not suitable for use.

MILTON.—No public water supply. The town is supplied by individual wells, springs or cisterns. Fourteen private well supplies were analyzed and 10 were condemned because of sewage pollution.

MONROE.—No public water supply.

MONT VERNON.—No public water supply. There is one town pump. Each dwelling, almost without exception, has its private well. Twenty-two well and spring supplies were examined. Eight well waters were condemned because of lead and sewage pollution, and eight were of good quality. Two of the five spring waters were not suitable for use.

MOULTONBOROUGH.—No public water supply.

Chemical Examination of Water from Tap of Pennichuck Water Works Company. Nashua.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
750	1902 Aug. 26	None	None	Slight veg.	0.0	6.00	1.50	.0000	.0000	.0000	.0000	.15	1.50	.....	..
1136	Apr. 12	None	Floc. veg.	Slight veg.	0.0	4.00	2.70	.0000	.0010	.0150	.0000	.17	2.00	.....	..
1137	Apr. 12	None	None	None	0.0	3.80	2.20	.0000	.0000	.0000	.0000	.15	2.40	.....	..
1395	July 3	Slight	Floc. veg.	V. dec. veg.	0.08	4.30	2.30	.0000	.0048	.0000	.0000	.20	2.20	.....	..
1396	July 3	Slight	Floc. veg.	V. dec. veg.	0.08	5.20	2.50	.0000	.0024	.0000	.0000	.20	2.20	.....	..
1978	1904 May 23	Very marked	S. fine	S. musty	0.6	4.10	1.10	.0000	.0024	.0350	.0000	.22	.90	.....	..
2384	Sept. 19	Slight	Consid. fine	V. dec. veg.	0.2	4.40	2.70	.0000	.0024	.0000	.0000	.20	1.40	.....	..

NASHUA.—No public supply. A private supply, the Pennichuck Water Works, installed by Nashua Aqueduct Company, in 1853, has for a source springs and wells. The wells, from 16 to 52 feet in depth, are driven through alternate layers of marl, sand, fine gravel and coarse gravel, and

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flow from 20 gallons to 275 gallons per minute. The reservoir, of 4,000,000 gallons' capacity, is 13 feet in depth. There are about 75 miles of cast-iron distributing mains; wrought iron, galvanized, is used for service pipes. The average daily consumption is 3,500,000 gallons, by 4,000 families, about 95 per cent. of the population. There are not over five or six wells.

Water from six private wells was analyzed, and three samples proved to be of good quality. Two were of doubtful quality, and one sample was highly polluted by sewage.

NELSON.—No public supply. The three well waters analyzed were of fair quality.

NEW BOSTON.—No water supply. The water supply of New Boston is from individual wells and springs. Three well waters were analyzed, two of which were badly polluted and unsuitable for use.

NEWBURY.—No public supply. At Blodgett's Landing there are two small private supplies from springs. There are two small reservoirs, one supplying 12 or 15 families; the other, five or six families. Three spring waters were analyzed. One sample contained a very large quantity of lead and the water was condemned; the other two samples were pure.

NEWCASTLE.—No public supply. Water is supplied by private wells and cisterns. The single well water examined was of good quality.

NEW DURHAM.—There is no public water supply in town. The individual family supply is from wells, principally dug wells, a few bored ones and a few springs.

NEWFIELDS.—No public water supply. Water all taken from wells or cisterns. One well water was analyzed and proved to be of fair quality. A water from a schoolhouse cistern was very foul, though otherwise of acceptable quality.

NEW HAMPTON.—No public water supply in town. Fifteen private spring and well supplies were analyzed, all but three of which contained lead. Nine were so badly polluted by lead that they were unfit for use.

NEWINGTON.—No public water supply.

NEW IPSWICH.—No public water supply. Water is taken about evenly from wells and springs. Twelve private well and spring supplies were analyzed, five of which were badly polluted by sewage and lead and therefore wholly unsuitable for use. The other seven samples were pure.

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NEW LONDON.—No public supply; water mostly from wells. Thirteen private well and spring supplies have been analyzed. Four of the well waters were badly polluted and six were of good quality. Two of the three spring waters were suitable for use though showing evidence of some past pollution. One spring water was condemned because of the presence of much lead.

NEWMARKET.—The public water supply, owned by the town, was built in 1894. The water, from springs, is pumped to a standpipe of 22,000 gallons' capacity. There are seven miles of cast-iron distributing mains, and the service pipes are of galvanized iron. The average daily consumption is 150,000 gallons. About 90 per cent. of the population are supplied from this system, but some private wells are still in use. The two well supplies examined were badly polluted. One spring water was of good quality.

NEWPORT.—The town owns and operates a system of water works supplied by a pond, or lake, of 66 acres; average depth about 30 feet; bottom largely sand and rock. The watershed is about four or five square miles, about two-thirds wooded; three families reside thereon. There are also one or two individuals who sell spring water. There are many individual wells in the locality.

Chemical Examination of Water from Tap of Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
844	1902 Oct. 9	None	None	Veg.	0.1	6.90	1.20	.0000	.0048	.0000	.0004	.10	.90	.....	..
2013	1904 June 2	None	None	S. musty	0.1	4.10	2.50	.0000	.0036	.0000	.0000	.15	1.60	.....	..

Of the six private supplies examined, two spring waters were condemned because of the presence of very much lead. The other supplies were of fair quality.

NEWTON.—No public water supply. Nearly every family has a well, some more than one. A few have no well, and depend upon neighbors for water. Six of the 11 private well supplies examined were so badly polluted by sewage as to be unsuitable for use.

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NORTHFIELD.—No public supply. The Tilton & Northfield Aqueduct Company, a private corporation, instituted, some 14 or 15 years ago, a water supply, the source being a pond fed by springs. The land is cleared for some distance from the water, and there are no houses within one half mile. There are not many individual wells in the vicinity. See special report elsewhere in this volume.

Chemical Examination of Water from a Faucet of the Tilton & Northfield Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
	1901													
11	May 28	V. slight	Slight	Distinct veg.	0.2	3.40	1.30	.0019	.0150	.0000	.0000	.09	....	.....
345	Dec. 31	None	None	None	0.2	2.90	1.20	.0044	.0136	.0050	.0000	.09	0.90	.....
	1903													
1219	June 1	Marked	Much floc. red.	V. slight	0.2	4.60	2.00	.0000	.0100	.0000	.0000	.10	1.10	.....
1431	Aug. 11	Slight	None	V. slight	0.15	3.00	1.00	.0000	.0074	.0000	.0000	.09	0.40	.....
1636	Nov. 2	None	None	None	0.0	2.80	1.30	.0000	.0050	.0000	.0000	.20	1.20	.....
	1904													
2022	June 7	Slight	Much fine	V. slight	0.3	4.40	2.20	.0000	.0098	.0000	.0000	.10	1.90	.....

Two private well waters were analyzed and both were found to be unsuitable for use.

NORTH HAMPTON.—No public supply. A charter is held by the North Shore Water Company, and the matter of supplying Little Boar's Head and Rye Beach with an ample supply of good water has been talked of for some years, but as yet no well-defined plan has been reached.

NORTHUMBERLAND.—No public water supply, excepting a small system at Groveton village, the source being a brook with an uninhabited watershed.

NORTHWOOD.—No water supply other than individual wells and springs.

NOTTINGHAM.—No public supply. Water is obtained from wells and springs. Wells are dug from 15 to 30 feet deep. The single well water examined was free from pollution.

ORANGE.—No public supply. All the water is obtained from private wells or springs.

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ORFORD.—No public supply. There are private supplies from springs, which furnish water to some 30 families. These springs are dug from six to eight feet deep, through sandy loam, subsoil rock. The water flows by gravity through iron and lead mains, with lead for service pipes. There are no individual wells in the vicinity. There are several other private springs.

Chemical Examination of Water from the Wilcox Springs.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
766	1902 Sept. 2	V. slight	Slight floc.	None	0.0	5.60	4.30	.0000	.0000	.0000	.0000	.05	3.20	.....	..

Five private well and spring supplies were analyzed. One well water was badly polluted by sewage and one otherwise good spring water was condemned because of the presence of much lead.

OSSIPEE.—There is no public water supply. Three of the five well supplies were considerably polluted by seepage from sewage-polluted ground and were classed as doubtful waters. One spring supply was of excellent quality except for the presence of much lead.

PELHAM.—No public water supply. All the houses in town but two are supplied by wells, which are believed to be in good condition. The two exceptions are supplied from springs, through lead pipes to cisterns in the houses.

PEMBROKE.—No public supply. There are two private supplies. The Suncook water works, built in 1896, is supplied from a pond having an area of 25 acres, 15 feet deep on an average, and a very muddy bottom. No inhabitants within two or three miles. The water flows by gravity. There are nine miles of distributing mains, cast iron; service pipes of galvanized iron. About 50 per cent. of the population are supplied from this source. The Baker & Dearborn water works were built in 1895, the source being a spring and Suncook River. The latter receives all the sewage of Pittsfield, 16 miles above. This river water is pumped to three reservoirs, 150 x 20, 50 x 20 and 50 x 20, and nine feet deep respectively. The distributing main is one mile in length and is of wrought iron; service pipes of galvanized iron. About 10 per cent. of the population take

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water from this supply. There are many private wells within the circuit of these two supplies.

Chemical Analysis of Water from the Suncook Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
744	1902 Aug. 25	None	None	Slight veg.	1.20	6.20	2.00	.0010	.0190	.0200	.0000	.15	1.90	.....
1331	1903 July 14	None	Floc. veg.	Slight veg.	1.50	6.10	.90	.0028	.0248	.0000	.0000	.15	.60	.....
1583	Oct. 12	None	None	Slight veg.	0.7	5.90	1.00	.0000	.0126	.0000	.0000	.17	.60	.....
1932	1904 May 8	None	None	Marked veg.	0.85	2 00	0.40	.0020	.0102	.0000	.0000	.12	.40	.....

Chemical Analysis of Water from the Baker & Dearborn Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
743	1902 Aug. 25	None	None	V. slight	0.0	5.80	3.80	.0006	.0014	.0300	.0000	.40	3.80	.....
1584	1903 Oct. 12	Slight	V. slight	Slight foul	0.2	3.60	1.90	.0020	.0026	.0030	.0000	.20	2.40	.....

Water from 13 private supplies has been analyzed. Nine of the 12 well supplies were of good quality, one contained much lead and was condemned and two were of doubtful quality. The single spring supply contained considerable lead which made it unsuitable for drinking.

Penacook (Ward 1, Concord).—The village of Penacook is supplied with water from two sources. That portion of the ward lying north of the Contoocook River is furnished from the Penacook and Boscawen water precinct system, the source being Walker Pond. For analysis and further description see Boscawen.

The remaining portion of the village is supplied with water from Pena-

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cook Lake by the Concord Water Works, the high pressure system of which was extended to Penacook in the summer of 1904. For further description see Concord.

Six well supplies were examined, and all were found to be polluted with sewage.

PETERBOROUGH.—In 1896 the town installed a water supply from a brook fed by springs. The watershed is three miles by one mile in extent, consisting of pasturage and woodland. It is a gravity system of approximately four miles of distributing mains, iron; service pipes of iron. There are quite a number of wells still in use, but they are gradually being given up. An additional supply is being considered for the town, the source being Cunningham Pond.

Chemical Examination of Water from Tap of Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
851	1902 Oct. 10	None	None	Decided veg.	0.4	6.30	1.80	.0000	.0062	.0000	.0000	.12	1.80	.....	..
1427	1903 Aug. 10	None	V. slight	Slight veg.	0.4	7.70	1.70	.0000	.0098	.0000	.0000	.10	1.60	.....	..
1452	Aug. 17	None	V. slight	V. slight veg.	0.32	5.00	2.00	.0000	.0072	.0000	.0000	.10	1.90	.....	..
1979	1904 May 23	None	None	None	0.3	3.50	0.50	.0000	.0046	.0000	.0000	.10	.70	.....	..

Water from 36 private well and spring supplies was examined. Ten spring waters contained too much lead to be suitable for drinking; eight were of good quality; and four contained small amounts of lead, and were classed as doubtful. Of the well supplies, eight were good; five were doubtful; and one was badly polluted by seepage from a barnyard.

PIERMONT.—No public supply. Nearly all the water used in town is obtained from springs on the hillside of sand and sandy loam. There are only nine wells in town. Lead pipe is used chiefly.

Two of the three waters analyzed were pure; one was condemned because of the presence of very much lead.

PITTSBURG.—There is no other water supply in this town than springs and a very few wells. Nearly every family has spring water.

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PITTSFIELD.—No public supply. The Pittsfield Aqueduct Company installed a supply from a pond in 1884. It is a gravity system. There are 11 miles of cement-lined iron mains, while the service pipes are of galvanized iron. Two hundred and seventy-five families, 95 per cent. of the population, take of this water. There are a few private wells in the village.

Chemical Analysis of Water from the Pittsfield Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1112	1903 Mar. 30	Distinct	Much fine	Veg.	0.2	3.90	1.70	.0024	.0046	.0100	.0001	.15	0.7	.....	..
1117	Apr. 1	Distinct	Much fine	Veg.	0.22	5.30	2.30	.0060	.0042	.0150	.0000	.15	1.40	.....	..
1456	Aug. 19	V. slight	V. slight	Decided veg.	0.22	2.70	1.10	.0060	.0068	.0060	.0000	.15	1.10	.....	..
1964	1904 May 24	Slight	Slight fine	Slight musty	0.15	3.00	3.20	.0020	.0046	.0080	.0000	.18	1.90	.....	..

Three well waters were analyzed and all were found to be polluted and unfit for drinking. One tap water from a pond was of good quality.

PLAINFIELD.—No public supply. A private supply was introduced in 1890–'91 by the Meriden Water Company. The source of the supply is springs dug from 7 to 10 feet deep, and flowing from 10 to 30 gallons per minute. The watershed has an area of about 100 acres, all cleared. The water flows by gravity to a reservoir 20 x 25 x 8 feet, and having a capacity of 1,000 barrels. Twenty families, besides the hotel and boarding-house, are supplied from this source. There are many individual wells in the locality.

Chemical Examination of Water from Tap of Meriden Water Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
880	1902 Oct. 13	Marked	Much min.	Slight	0.1	10.00	5.00	.0000	.0600	.0000	.0000	.06	4.50	.....	..
1974	1904 May 23	None	None	Slight earthy	0.0	5.60	4.70	.0024	.0038	.0300	.0000	.10	4.50	.....	..

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One well supply was analyzed that contained the *Bacillus Colon Communis*. Two stream waters examined were of poor quality, one showing the presence of much sewage. Two ice samples were of fair quality.

PLAISTOW.—All of the water used in this town is obtained from individual wells.

PLYMOUTH.—The town installed a system of water works in 1880 and 1881, the supply being from springs and wells. The average depth of the wells is six feet. A foot of top soil is loam; below the loam is marl and gravel. The wells are dug. The water flows by gravity to two reservoirs having a capacity of 4,000,000 gallons; area, one acre; average depth, 12 feet. There are several individual wells in the locality.

Chemical Examination of Water from Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1902														
627	June 30	V. slight	None	Veg.	0.25	8.00	3.10	.0000	.0054	.0000	.0000	.10	2.30	.....	*
629	June 30	Slight	Slight	Veg.	0.26	7.80	3.10	.0006	.0084	.0000	.0000	.12	2.30	.....	†
630	June 30	Slight	Slight	Decided veg.	0.26	8.10	2.00	.0006	.0120	.0000	.0000	.07	1.90	.....	‡
631	June 30	Slight	None	Decided veg.	0.26	6.40	2.50	.0000	.0072	.0000	.0000	.07	1.90	.....	§
	1903														
1406	Aug. 5	V. slight	Slight	V. slight	0.2	5.00	2.70	.0000	.0066	.0000	.0000	.07	2.40	.....	..
1585	Oct. 12	None	V. slight	None	0.25	7.40	4.70	.0016	.0052	.0150	.0000	.20	3.10	.....	‖
1586	Oct. 12	None	Slight	None	0.2	7.10	3.80	.0000	.0036	.0200	.0000	.20	3.60	.....	§§
	1904														
1992	May 27	Slight	Slight	Decided veg.	0.25	5.20	2.60	.0008	.0042	.0000	.0000	.10	1.80	.....	..

* Sample taken from faucet in mill.
† Sample taken from Reservoir No. 1.
‡ Sample taken from Reservoir No. 2.
§ Sample taken from faucet in drug store.
‖ Stream to Reservoir No. 2.
§§ Stream to Reservoir No. 1.

Water from 23 private supplies was analyzed. Of 16 well supplies seven were pure; eight were badly polluted either by sewage or lead, and one was of doubtful quality. Four of the seven spring supplies were unfit for use; three contained much lead, and one was contaminated by sewage.

PORTSMOUTH.—The city constructed a system of water works in 1891, the source being wells and springs. The watershed is about four square

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miles in area, partly wooded; no inhabitants very near. The wells are driven from 70 to 100 feet, in gravel. The water is pumped to a standpipe having a capacity of 500,000 gallons. There are very few private wells.

Chemical Examination of Water from Portsmouth Water Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
621	1902 June 27	None	Slight floc.	Slight aromat.	0.0	10.40	8.80	.0000	.0018	.0150	.0000	.27	4.50	.....	..
1405	1903 Aug. 4	None	Slight	None	0.0	16.50	11.10	.0000	.0010	.0500	.0008	.57	8.70	.....	..

Water from nine private supplies was analyzed. Three well waters were of doubtful quality, and four were good; one spring water was heavily polluted by sewage, and one was pure. Two distilled waters proved to be of very poor quality.

Randolph.—No public water supply.

Raymond.—In 1893 the town installed a public water supply from a system of wells driven from 40 to 60 feet deep, through loam, sand and gravel. The water is pumped to a standpipe having a capacity of 118,037 gallons. The watershed is about one square mile in area, is about equally wooded and cleared, and on it are about 600 inhabitants. There are a few wells in the locality.

Chemical Examination of Water from Faucet of Raymond Water Works.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
876	1902 Jan. 24	None	None	V. slight	0.0	11.90	8.50	.0010	.0064	.1900	.0000	1.62	4.20	.....	..
1404	1903 Aug. 4	Slight	V. slight fine	Slight	0.0	18.10	11.90	.0030	.0020	.2900	.0002	2.15	6.00	.....	..
2018	1904 June 6	None	None	None	0.05	19.10	14.20	.0010	.0020	.4000	.0000	2.65	7.70	.....	..

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The quality of this water is steadily growing worse. At the present time the supply is receiving such large amounts of filtered sewage that the composition of the water is seriously affected. It is only a question of time before the supply will have to be abandoned for drinking and domestic purposes.

RICHMOND.—No public supply. Each family, as a rule, has its individual well. There is one well, however, that is owned by several neighbors, for their own private accommodation, especially when other wells may be dry in summer. One hotel is supplied from a private well across the street, and from another in the hotel cellar.

RINDGE.—No public supply. Two well supplies were analyzed; one was very badly polluted by sewage, and the other was of good quality.

ROCHESTER.—The Rochester water works, owned by the city, installed in 1885, has for a source a pond and reservoir, the pond being about one hundred acres, and the reservoir two hundred acres in area. The watershed, several square miles in extent, is both wooded and cleared, with, perhaps, 75 inhabitants. There are not many private wells in the locality

Chemical Examination of Water from Tap of City Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
878	1902 Oct. 17	None	None	Slight veg.	0.15	5.70	1.00	.0000	.0086	.0000	.0000	.15	.90	.....	..
1436	1903 Aug. 13	Very marked	Much fine veg.	Peculiar veg.	0.35	7.00	2.10	.0036	.0560	.0000	.0000	.20	0.40	.....	..
2020	1904 June 6	Slight	Consid. fine	Dec. m'sty v'g	0.2	3.10	2.20	.0020	.0198	.0000	.0000	.15	2.00	.....	..

Four of the seven well waters analyzed were badly polluted by sewage, and were unsuitable for drinking. The single spring water analyzed was pure.

ROLLINSFORD.—No public water supply, the only source being wells and springs, samples from many of which have been analyzed at the State Laboratory of Hygiene, and in a majority of cases found to be unfit for domestic use. There are a number of citizens who would be glad to see a system of water works installed in the village. But one well water was

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analyzed and that was of fair quality. A spring water from Salmon Falls was polluted by sewage and unsuitable for use.

ROXBURY.—No public supply. Some families use the old wells, but most of them are supplied with running water from the hills. One spring water was analyzed and found to be of excellent quality.

RUMNEY.—This town is supplied with water from private wells and springs. Four water supplies have been analyzed. One spring supply was pure and two were badly contaminated by lead. The single well water analyzed was not suitable for use.

RYE.—No public supply. The entire water supply is taken from private wells and springs. One well water was found to be wholly unfit for use, and one was of fair quality.

SALEM.—A private water supply was installed in 1903 by the Salem Water Works Company. The source of the supply, Canobie Lake, is of about 1,000 acres in area, 40 feet in depth on an average, and gravelly bottom. The watershed is approximately 500 acres, mostly wooded. The shores of the pond, upon which is Canobie Lake Park, is frequented by summer cottagers and excursionists. The water flows by gravity through about three miles and a half of iron main pipe, and the service pipes are of galvanized iron. It is estimated that 15 per cent. of the population use this water.

Chemical Examination of Water taken from Policy Pond, otherwise known as Canobie Lake.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
238	1901 Oct. 27	None	Slight	Decided veg.	0.1	2.80	1.50	.0000	.0176	.0000	.0000	.21	1.20	.....	*
229	Oct. 27	None	Slight	Decided veg.	0.1	3.00	1.20	.0000	.0192	.0000	.0000	.23	1.20	.....	†
2045	1904 June 13	Slight	Slight	Marked veg.	0.05	6.20	2.80	.0014	.0136	.0000	.0000	.30	2.60	.....	..

*Sample No. 228 was collected opposite Crosse's Grove. †No. 229 opposite Chase's Grove.

One well water was analyzed which was of doubtful quality. See "Protection of the Water Supply of Salem," printed elsewhere in this report.

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SALISBURY.—No public water supply. Two well waters were analyzed and one found to be very badly polluted by sewage. The single spring water examined was of good quality.

SANBORNTON.—No public water supply. Two private supplies were examined; one, a spring, was of good quality. The other, a well water, showed evidence of considerable sewage pollution and was classed as doubtful.

SANDOWN.—No public water supply. One well supply was analyzed and found to be pure.

SANDWICH.—No public supply. Practically every house has its individual well. Some of the water is conveyed through lead pipe.

SEABROOK.—No public water supply.

SHARON.—No public supply. Water is obtained entirely from springs and wells.

SHELBURNE.—No water supply except private wells and springs.

SOMERSWORTH.—A system of water works was installed by the city in 1895, from Salmon Falls river, which received the sewage of East Rochester and the woolen mills there. The water is pumped to a standpipe having a capacity of 997,000 gallons. There are several private wells within the radius of this supply, but many who have wells have city water also.

Seven private well supplies were analyzed. Two were polluted by sewage, and the others were of fair quality.

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Chemical Examination of Water from Faucet of City Water Works, Somersworth.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
60	1901 July 11	None	None	Decided veg.	0.7	4.50	2.50	.0074	.0167	.0050	.0003	.33	1.80	.....
497	1902 May 5	None	None	Veg.	0 5	4.00	1.90	.0006	.0056	.0200	.0000	.15	1.20	.....
585	June 11	None	None	Slight veg.	0.55	6.60	1.50	.0000	.0092	.0200	.0000	.14	1.20	.....
647	July 14	None	None	Decided veg.	0.6	4.70	2.20	.0000	.0098	.0200	.0000	.14	1.80	.....
657	July 17	None	V. slight	V. slight	0.5	6.10	2.20	.0020	.0154	.0200	.0000	.15	2.20	.....
788	Sept. 9	None	None	Slight veg.	0.45	8.30	2.40	.0014	.0100	.0100	.0000	.15	2.40	.....
935	Nov. 21	None	None	Slight veg.	0.5	5.20	1.60	.0000	.0082	.0000	.0000	.20	1.60	.....
1018	1903 Jan. 30	None	None	Veg.	0.5	8.40	2.40	.0000	.0060	.0000	.0000	.15	2.30	.....
1312	July 8	None	V. slight	V. slight veg.	0.6	5.50	1.20	.0000	.0046	.0150	.0000	.08	1.20	.....
1424	Aug. 10	None	V. slight	Veg.	0.4	5.90	2.30	.0000	.0086	.0300	.0000	.20	2.30	.....
1832	1904 Feb. 9	Slight	None	Marked veg.	0.4	4.70	2.40	.0018	.0046	.0000	.0000	.20	2.00	.....
2007	May 31	None	Slight	V. slight	0.45	5.80	1.90	.0000	.0048	.0000	.0000	.18	1.50	.....
2199	July 25	None	None	V. slight	0.4	6.80	3.70	.0006	.0038	.0000	.0000	.25	3.70	.....

South Hampton.—There is no public supply in town. Water for family use is all from wells. A few springs are used for barnyard and highway purposes.

Springfield.—The water supply of this town is entirely from private wells and springs. One of the two well supplies analyzed was badly polluted by sewage, and the other was of fair quality.

Stark.—No public supply. Water is obtained from springs and driven wells.

Stewartstown, West.—No public supply. The Consolidated Water Company furnishes water to 25 families, the source being several springs and a few wells. There are still a few deep wells in the locality, dug from 15 to 20 feet, on a level with the river, and which have good supplies of water. The one spring water examined was of good quality.

Stoddard.—No public supply. Most of the families are supplied from individual wells; a few from Long Lake.

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STRAFFORD.—No public supply. Water is obtained from individual wells, the pipes used being partly lead and partly galvanized iron.

STRATFORD.—No public supply. The village of North Stratford has two private water supplies. In 1882 Mr. Clark Stevens installed a supply from a system of springs, the watershed being about 60 acres, mostly cleared land, no inhabitants. The springs are seven in number, stoned from five to seven feet deep. In 1888 Mr. J. C. Hutchins introduced a second supply, also from springs stoned about six feet deep, with same kind of soil as first supply. The watershed is about five square miles in area, mostly cleared land, no inhabitants.

Chemical Examination of Water of Stratford.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
800	1902 Sept. 11	None	None	None	0.0	5.60	2.20	.0010	.0030	.0150	.0000	.05	1.90	.....	*
801	Sept. 13	None	None	None	0.0	6.10	2.10	.0000	.0000	.0200	.0000	.05	2.00	.....	†

* Sample No. 800 was taken from faucet of J. C. Hutchins' water supply. † No. 801 from faucet of Clark Stevens' water supply.

STRATHAM.—No public supply. There is one private supply, pumped by windmill from a spring to an out-of-doors tank, from which four houses are supplied. The water supply of the town is chiefly from individual wells and springs. A few filtered cisterns are used. Three well waters were analyzed, two of which were found to be of doubtful quality.

SULLIVAN.—Individual wells and springs are the only water supply.

SUNAPEE.—The Sunapee Water Works, owned by the town, were built in 1901, Sunapee Lake being the source from which water is taken to supply the Sunapee village, and Ledge Pond for George's Mills. Water from the pond flows by gravity, while that from the lake is pumped to a reservoir of 300,000 gallons' capacity. The Lake Sunapee Water Supply Company, a private company of 23 stock owners and takers, installed its works in October, 1886. The water is taken from Sunapee Lake, and flows by gravity. The plant is nearly worthless at this time, as the pipes are of small size and filled with rust.

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Chemical Examination of Water from Lake Sunapee.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
306	1901 Dec. 4	Slight	Much floc.	Decided veg.	0.6	3.00	1.80	.0000	.0094	.0000	.0000	.08	1.50	.0400	*
823	1902 Sept. 22	None	Slight	Slight musty	0.1	3.50	.60	.0000	.0112	.0000	.0000	.07	.60	.....	†
824	Sept. 22	None	V. slight	Decided veg.	0.15	3.40	.70	.0000	.0090	.0000	.0000	.10	.60	.....	‡
1418	1903 Aug. 10	V. slight	V. slight	V. dec. veg.	0.1	3.60	2.80	.0000	.0080	.0400	.0000	.07	2.80	.....	‡
1419	Aug. 10	None	V. slight	Decided veg.	0.05	3.50	0.90	.0000	.0122	.0000	.0000	.05	.90	.....	†
2019	1904 June 6	None	V. slight	S. foul	0.2	3.50	2.10	.0012	.0052	.0000	.0000	.10	2.00	.....	‡

* Sample taken from private supply through 150 feet of lead pipe.
† Sample taken from Ledge Pond, George's Mills water supply.
‡ Sample taken from Lake Sunapee, supply of Sunapee Water Works Company.

Fourteen spring waters were analyzed, and but three found to be pure. Nine contained so much lead that they were unsuitable for use. Four of the seven well waters were good and three were polluted by sewage or lead.

Surry.—No public supply. Water is obtained from wells dug about three feet deep, on a hillside, and are fed by springs. The water flows by gravity, about one mile, through lead pipe. Fourteen families are so supplied.

Sutton.—The water used in this town is obtained from private wells and springs. Some wells are near buildings, and pumps are used; in other cases the water is conducted through lead pipes from springs back in the hills.

Nine private well and spring supplies were analyzed; four were of good quality, three were badly polluted by lead or sewage and two are of doubtful quality.

Swanzey.—No public supply. A private well at West Swanzey furnishes water for four or five families from a small reservoir fed by springs, but the water is not used to any extent for drinking.

Five of the six well waters analyzed were polluted by sewage and unsuitable for use. One was of good quality. The two spring supplies were both somewhat contaminated by excess of organic matter, but were reported as suitable for drinking.

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TAMWORTH.—No public supply. Water is obtained from individual springs and wells. Two well waters and one spring water were analyzed and all were of good quality.

TEMPLE.—No public and no private system of water works. Water is obtained from individual springs, which flow by gravity and from wells.

THORNTON.—No public supply. Water is obtained from springs and wells, through lead and iron pipes.

TILTON.—No public supply. A private supply was installed by the Tilton & Northfield Aqueduct Company in 1887–'88, the source being a pond of about 60 acres in area, from 10 to 75 feet deep; sand and gravel bottom, with but very little mud. The water shed is several hundred acres in extent, wooded and pasture, with five farms. There are still a very few wells in the locality, although most of them have been abandoned.

Chemical Examination of Water from a Faucet in Tilton Supplied by the Tilton & Northfield Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
11	May 28	V. slight	Slight	Distinct veg.	0.2	8.40	1.30	.0019	.0150	.0000	.0000	.09	....	.....	..
345	Dec. 31	None	None	None	0.2	2.90	1.20	.0044	.0136	.0056	.0000	.09	.90	.....	..
	1903														
1219	June 1	Marked	Much floc. veg.	V. slight	0.2	4.60	2.00	.0000	.0106	.0000	.0000	.10	1.10	.....	..
1431	Aug. 11	Slight	None	V. slight	0.15	3.00	1.00	.0000	.0074	.0000	.0000	.09	0.40	.....	..
1636	Nov. 2	None	None	None	0.0	2.80	1.30	.0000	.0050	.0000	.0000	.20	1.20	.....	..
	1904														
2022	June 7	Slight	Much fine	V. slight	0.3	4.40	2.20	.0000	.0098	.0000	.0000	.10	1.90	....	..

Eleven private well and spring waters were analyzed. Both the spring waters were badly contaminated by lead. Five of the nine well waters were of good quality, three were of doubtful quality and one was very heavily polluted by sewage. One ice was analyzed and found to be very pure. See "Protection of Tilton and Northfield Water Supply" elsewhere printed in this report.

TROY.—No water supply other than individual wells and springs. Sixteen well waters were analyzed, of which twelve were polluted and unfit

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for use; three were good and one was of doubtful quality. Six of the 12 bad waters were so reported because of the presence of much lead.

TUFTONBOROUGH.—No public supply.

UNITY.—No public water supply. The people are supplied with water chiefly from wells. A few have running water from individual aqueducts. It is believed that many of the wells furnish poor water.

The single spring supply analyzed contained much lead and was, therefore, condemned as unfit for use.

WAKEFIELD.—No public supply. There are two driven wells in town; the others are dug and are not more than 15 to 20 feet deep, on an average.

Thirteen well waters have been analyzed with the result that four were good, four doubtful and five so polluted by sewage as to be unsuitable for use.

One spring water was of good quality and one brook water was also pure.

WALPOLE.—The North Walpole Village Precinct Water Works, owned and managed by the precinct named, was installed about 35 years ago by Nathaniel Monroe. There are four springs;, one flowing 25 gallons per minute, is pumped to a reservoir; three others run into cement-lined pipes and supply 84 families, and have a capacity for 30 more. The soil is fine gravel. Two hundred and forty families are supplied from this source.

A new system of water works is in process of construction at Walpole, by the Walpole Water and Sewer Co., and is expected to be completed by the 1st of December, 1904. The source of the supply is a stream and springs, with a watershed of three or four square miles, both cleared and wooded. There are no inhabitants on the watershed. The water will flow by gravity three and four-fifth miles, through iron mains; service pipes of galvinized iron. The system will supply 50,000 gallons per day, while the average daily consumption will probably be less than that.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
2082	1904 June 20	None	S. floc.	S. musty	0.1	7.80	4.60	.0048	.0082	.0200	.0000	.15	4.10	.....	..
2119	July 3	Slight	Slight	S. veg.	0.1	5.50	3.90	.0052	.0088	.0000	.0000	.15	3.20	.....	*

*B. Coli present.

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Of the five well waters analyzed four were polluted and unsuitable for use.

Four spring waters were also analyzed and two were found to be pure, one doubtful and one so full of lead that it was unsuitable for drinking. A cistern water was found to be unsuitable for use.

WARNER.—No town supply. In 1895 a supply was introduced by private parties, which was later purchased by the Warner Village Fire District. This consists of a reservoir supplied by springs and a brook. The bottom is clayey hardpan in part, and part gravel; average depth, eight feet. The watershed is estimated at 400 acres, wooded; not more than 12 inhabitants. The volume of water varies greatly. The water flows by gravity. There are quite a number of private wells in the locality. There are many private supplies which are piped from springs long distances through lead pipe.

Chemical Examination of Water from a Faucet of the Village District Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.			
754	1902 Aug. 29	None	None	V. slight	0.3	5.30	2.00	.0000	.0110	.0000	.0000	.10	1.50	.....
1417	1903 Aug. 10	Slight	Fine	Foulveg.	0.1	4.20	1.60	.0000	.0106	.0000	.0000	.08	1.60	.....
2122	1904 July 6	Slight	S. fine	S. veg.	0.25	5.60	2.10	.0000	.0050	.0000	.0000	.10	1.20	.....

Twenty well waters were analyzed, of which eight were pure, seven bad and five doubtful. Six of the seven polluted waters and all of the doubtful waters were so classed because of the presence of lead. One of the two spring supplies analyzed was condemned because of the presence of lead.

WARREN.—No public supply. There are two private systems of water works in town; one, the Warren water works, was built in 1873, the source being a spring about a mile distant. The water flows by gravity through galvanized iron pipe. Nineteen families are supplied from this source. The other supply, the H. N. Merrill Water Works, was installed about the year 1895. This supply is from a spring and driven well 474 feet deep. The water flows partly by gravity and partly by being pumped into a reservoir. Eighteen or 20 families take from this supply. There are not many private wells within the radius of these supplies.

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Chemical Examination of Water from Various Sources.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
875	1902 Oct. 17	Slight	Fine	V. slight	0.1	7.20	2.60	.0000	.0116	.0000	.0500	.09	1.95	.....	*
877	Oct. 17	None	None	S. veg.	0.1	6.50	2.70	.0000	.0033	.0000	.0000	.10	2.70	.....	*

*Sample No. 875 is from H. N. Merrill Water Works; No. 877, from Warren Water Works.

The single well water analyzed was pure.

Washington.—No public water works. The town being quite hilly, a great many families have put in private aqueducts at comparatively small expense. It is probable that nearly or quite half the farms have aqueducts suppyling house or barn or both. Lead pipe has generally been used to conduct the water, although of late iron pipe has been employed to some extent.

Of ten well supplies analyzed six were polluted either by sewage or lead.

Waterville.—No public supply.

Weare.—No public water supply. Four families at Riverdale are supplied from a spring, by lead pipe. The works were put in about 60 years ago by Christopher Simons, who supplied the village with excellent water. Later, the owner of the spring asked several parties to put their faucets on a level with his; they would not. He cut the pipe and laid a new line to supply the four families mentioned. The others now depend upon wells. At North Weare four families get water from a spring, through pipe not lead. Wells are generally used, although quite a number in town have running water from springs.

Of five well supplies two were badly polluted by seepage, two were of good quality and one was doubtful. The one spring supply was pure.

Webster.—No public water supply. Water is supplied by private works from springs and wells. Two well waters were analyzed. One water was of good quality, but the other was badly polluted by seepage.

Wentworth.—There are no public water works in town. The supply is from wells and springs. The single spring supply examined contained much lead and was unsuitable for drinking.

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WENTWORTH'S LOCATION.—No public supply.

WESTMORELAND.—No public supply.

WHITEFIELD.—The public water works, owned by the town, were built by private parties in 1892. The water is from streams, and flows by gravity to a reservoir having a capacity of 800,000 gallons. There are two watersheds of about 30 acres each. The remainder obtain water from individual wells.

Chemical Examination of Water from Town Supply.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
861	1902 Oct. 14	None	Slight floc.	Veg.	0.0	5.00	1.50	.0000	.0026	.0000	.0000	.04	1.50	.....	..
1429	1903 Aug. 11	None	None	S. veg.	0.1	6.60	2.60	.0050	.0034	.0000	.0000	.05	1.40	.....	..
2143	July 11	None	None	V. slight	0.0	4.40	2.40	.0022	.0058	.0000	.0000	.07	1.60	.....	..

Five private supplies were analyzed and two well waters were found to be so heavily contaminated by seepage that they were unsuitable for use.

WILMOT.—No public and no private water works. The supply of this town is from individual springs or wells. One spring water contained much lead and was unsuitable for use. A well water also contained so much lead that the supply was reported as of doubtful quality.

WILTON.—A gravity water system is now being constructed which will supply the village of East Wilton with water for domestic purposes and fire protection. The source of the supply is Mill Brook, with the intake at Gaerwen Falls, 250 feet above the bridge at East Wilton, about $1\frac{2}{3}$ miles from the village. Mill Brook, or Gaerwen Falls Brook, rises on the eastern slope of the Pack Monadnock range of mountains and has a watershed of nearly four square miles. It is also the outlet of Burton Pond, a sheet of water some 60 acres in extent which is dammed and will serve as an admirable storage reservoir.

The committee appointed by the town to study the feasibility of a water supply collected samples of water from various sources that were suitably located for supplying the town and sent them to the State Laboratory for analysis, with the suggestion that a chemical and bacterio-

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logical analysis be made to determine their relative purities. The reports of the analyses, together with various communications, are given below:

CONCORD, N. H., March 17, 1904.

S. B. Center, Wilton, N. H.

DEAR SIR:—I enclose analyses of the five samples of water collected from the various sources under consideration as a water supply for your town. The waters are all of good quality and there is but little choice between them, so far as their chemical composition is concerned. One sample shows the presence of the colon bacilli, as I have noted on the report, but the other waters are free from any fecal contamination. I am convinced that your brooks are of good quality, and, other things being equal, will afford you an acceptable water supply. Other analyses may show different conditions and should be made as frequently as possible. It will be well to take samples directly after a heavy rain or shower, when the brooks are swollen by surface water.

I shall be glad to come to Wilton whenever you may suggest, and the only cost to the town will be my traveling expenses.

Very truly yours,

H. E. BARNARD,
Chemist.

CONCORD, N. H., May 4, 1904.

Mr. S. B. Center, Wilton, N. H.

DEAR SIR:—I enclose a report of the examination of the proposed water supplies for your town. I have discussed the Gaerwen Falls supply somewhat in detail as being most probably the supply you will finally select.

I also enclose the results of analysis of the two waters sent in on Monday. There is no question but that the Burton Pond water is of good quality. It is somewhat colored at present, just as the water at the dam is colored, by the dissolved vegetable matter always present in surface waters.

I will send you more bottles shortly, that you may take other samples of water at the dam. It is well to have a series of analyses which will show conclusively the permanent character of the water.

I have not sent you more copies of the analyses of the waters made on March 17, as you probably have them on hand.

Very truly yours,

H. E. BARNARD,
Chemist.

CONCORD, N. H., May 4, 1904.

Mr. S. B. Center, Wilton, N. H.

DEAR SIR:—In accordance with your request of March 8, 1904, for our assistance in regard to examinations of the proposed supplies for a gravity water system for the town of Wilton, we have made both chemical and bacteriological analyses of the waters collected by you from five possible sources of supply, viz.: Gaerwen Falls Brook, brook on land of Mrs. R. W. Ward, Blood Brook, Miller Brook and small brook in Peabody meadow. The results of the analyses showed all the waters to be of acceptable character from a chemical standpoint. Bacteriologically the water from brook on land of Mrs. R. W. Ward showed the

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presence of the colon bacilli, an evidence of fecal contamination, while the other supplies were entirely satisfactory.

It seemed advisable to make a personal examination of the proposed supplies to determine the character of the watersheds and the number of inhabitants thereon; the presence of mills and pollution by manufacturing operations.

On the 20th of April an extensive examination was therefore made of four of the proposed supplies, the results of which are here given.

GAERWEN FALLS BROOK.

The Gaerwen Falls Brook was traced from the falls to Burton Pond. But small areas of swamp land drain into the stream and no muddy places were observed which would depreciate the quality of the water. The watershed is extensive and consists of both woodland and cleared land, pastured or cultivated. No farm drainage can reach the stream directly except that from the old Hillsborough County Farm, several miles above the falls, and the quantity derived from that source is slight and will not impair the quality of the supply.

The sewage from the several houses at Davisville is evidently satisfactorily disposed of, and cannot reach the brook. The manufacturing plant at Davisville is located on the banks of the brook and may prove a source of pollution unless suitably provided with a system for sewage disposal. The manufacturing waste from this source is slight and cannot be of injury. Some distance above this plant there is a large pile of sawdust, which is so located that it will enter the stream in time of high water or during heavy rains. This source of pollution can be readily removed. Still further up the stream is a sawmill in active operation during part of the year, which discharges its waste and sawdust directly into the stream. This pollution of the water renders the sawmill a nuisance and the State Board of Health has authority to suppress it when so petitioned. The sawmill is not, therefore, an objectionable feature of the proposed supply.

BURTON POND.

An examination was also made of Burton Pond, which is a natural reservoir for the system, and at all seasons contributes largely to supplying the stream. This pond is admirably located in a natural basin with wooded watershed and a shoreline free from decaying vegetation or swamp land. Recent chemical and bacteriological analyses of the Burton Pond water accompany this report.

The results of the various analyses of the Gaerwen Falls supply have been uniform and show the water to be of good quality, very soft, free from turbidity and excessive sediment, with a slight vegetable odor and color, due to dissolved organic matter. The chlorine content is normal, the solids are very low; ammonia in its oxidized conditions, as nitrates and nitrites, is absent, and that present as free and albuminoid ammonia is wholly due to the vegetable matter always dissolved in pond or surface waters. The bacteriological examination shows the water to be practically free from bacteria, but a biological examination shows Cyclops, of the order of Copedoda Crustacea, to be present in considerable numbers. The Cyclops are aptly termed "water scavengers" and are found very generally in our best pond supplies. Their presence is not considered detrimental, and as they rarely pass through the service pipes to the consumer they will never give trouble.

Taking into consideration the location of the stream, the character of its

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watershed, its freedom from excessive organic contamination, and the uniformly good condition of the water, it would seem to be a wholly satisfactory source of water supply.

STREAM IN PEABODY MEADOW.

Peabody Meadow, which is so located as to be readily converted into a storage reservoir fed by small streams, has been considered as a source of water supply. The fact that it is the natural drainage outlet for several farms and houses, which deliver sewage from barns and sink drains on the slope but a few rods above the high water mark of the proposed reservoir, renders it at all times liable to pollution. This source is, therefore, not a suitable one for furnishing a water supply.

BLOOD BROOK.

Blood Brook is an excellent stream for a water supply and will furnish water similar in composition to the Gaerwen Falls Brook.

Chemical and bacteriological examinations show the water to be pure, soft, and in every way suitable for drinking and domestic uses.

MILLER BROOK.

This proposed source is a large stream with a watershed many miles in extent, mostly wooded and but sparsely populated. The composition of the water is similar to that from the Gaerwen Falls and Blood Brook and, like them, is such as to make it admirably adapted for a town supply.

In conclusion it is sufficient to say that any one of the three sources,—Gaerwen Falls Brook, Blood Brook or Miller Brook, will be a suitable supply for the town of Wilton and will furnish water free from pollution and, except for a slight color and odor, of unexcelled quality.

Very truly yours,

H. E. BARNARD,
Chemist.

State Laboratory of Hygiene.

WILTON, N. H., June 6, 1904.

Mr. H. E. Barnard, Chemist, State Board of Health, Concord, N. H.:

DEAR SIR:—I have examined your reports of analyses of water from several sources from Wilton and your letters giving your opinion of their quality, etc. I note that you consider Burton Falls and Mill Brook, on the latter of which lies Gaerwen Falls, an entirely satisfactory source of supply for a public water system for the village. You do, however, mention the presence of a slight vegetable odor and color in the water from these sources. Inasmuch as these things are noticeable by the senses and would affect the confidence of the people in the water, even though the latter were entirely healthful, the committee desires more information on these two points of color and odor. Perhaps this may best be obtained by answers to the following questions:

Are analyses of water taken in all or many of the months of the year necessary for a complete examination of its qualities, odor, color, etc., etc.?

At the very worst would anything more be required for the removal of this color and odor, so far as water from Burton Pond is concerned, than the clearing out of the vegetable matter and mud, if any there be, from the bottom of that reservoir?

Is vegetable color and odor present in the same degree as in these waters in

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the public water supplies of some other towns in the state (giving their names), and yet are those supplies satisfactory to their inhabitants?

Any remarks that you may make other than answers to these questions will be gratefully received. A prompt reply is desired since the committee wish to put its report in print during the last of this week.

Yours truly,

I. S. WHITING,
Chairman.

CONCORD, N. H., June 7, 1904.

Mr. I. S. Whiting, Wilton, N. H.:

DEAR SIR: — I am pleased to give you further information concerning the quality of the Gaerwen Falls and Burton Pond supply and enclose a set of analyses of the waters of most of the cities and larger towns of the state which will be of service to you as showing the comparative results of sanitary analysis.*

It must be realized at the outset that a surface water,—a water which reaches the earth as rain and after flowing over the ground collects in natural reservoirs or streams,—is different in composition from ground water,—water which has passed through greater or less depths of earth and finally collected in porous strata from which it is lifted to the surface by pumps or naturally through springs.

Ground water is filtered water and therefore is usually colorless; surface water is unfiltered and invariably contains more or less dissolved vegetable matter as well as suspended vegetable and mineral matter that imparts a color to the water. Yet in spite of the aesthetic advantage of having a supply free from color, by far the greater number of supplies in this state,—and all of the large supplies in New Hampshire and throughout the country,—are surface waters.

Replying to your last question first, I may say that while the water supply of Concord is somewhat more free from color than your proposed supplies, the supplies of Manchester, Somersworth, Plymouth, Warner, Peterborough, Antrim, Hooksett and Pembroke,—all of which are excellent and satisfactory supplies,—are colored as highly, and in several instances much more heavily, than the Burton Pond water. The odor of these waters is not more noticeable than is always observed in pond waters, or in brook waters which do not originate as springs. Neither the odor nor color of any of our public supplies creates a prejudice against its use after the change from a well water to a surface water no longer attracts attention. The analyses I have made of the proposed supplies for your town have been made at the most unfavorable season of the year, and I think that the water will be even more satisfactory during the summer and fall than it now appears from the results of analyses made in April and May.

The chemical composition of the water will vary but little through the year. Extremely long periods of great heat coupled with low water will sometimes produce a decomposition of vegetable material that will impart an unpleasant odor to waters. This is particularly noticeable in storage reservoirs. In the case of Burton Pond I do not think such a condition is possible as the dam at the outlet furnishes a ready means of regulating the height of the water and so enables one to keep all portions of the bottom under water. It is undoubtedly true that Burton Pond water will be improved somewhat by clearing out all pockets

* The table of analyses referred to is omitted from this report.

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of mud and eradicating vegetable matter. I do not think even this will be necessary, as I understand the dam has been built for many years and that all stumps and turf covered by the flowage have completely decomposed.

I wish to call to your attention one factor in the tables of analyses that shows conclusively the amount of vegetable matter in a water,—that is, the albuminoid ammonia content. This factor depends upon the same conditions that produce the odor and color, and a high odor and color denotes a high albuminoid ammonia. The water from Burton Pond is low in albuminoid ammonia for a surface water,—much below the content of most of the supplies of the state from similar sources,—and the water from the falls runs still lower.

I can see no possible objection to the proposed supply because of color or odor if a surface water is to be chosen. If a water is desired that is colorless and odorless a well water is the only water that will meet the conditions. As between a colorless well water that is always liable to pollution and a surface water that is slightly colored and absolutely secured from contamination, there can be but one choice.

Very truly yours,

H. E. BARNARD,
Chemist.

Chemical Analysis of Water from Gaerwen Falls.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1869	1904 Mar. 13	None	Slight floc. veg.	Marked veg.	0.2	4.30	2.10	.0010	.0048	.0000	.0000	.15	1.25	.....	..
1915	May 1	None	Floc. veg.	Slight veg.	0.3	2.80	1.20	.0014	.0082	.0000	.0000	.12	.70	.....	..
1982	May 23	Slight	Much veg.	Much veg	0.35	4.80	1.20	.0000	.0076	.0000	.0000	.10	1.10	.....	..
2124	July 5	V. slight	Slight	Slight veg.	0.25	4.80	1.50	.0000	.0074	.0000	.0000	.15	.70	.....	..
2274	Aug. 14	None	V. slight	Musty veg.	0.25	4.20	1.90	.0000	.0034	.0000	.0000	15	.40	.....	*
2363	Sept. 13	V. slight	V. slight	Decided veg.	0.20	3.70	1 70	.0014	.0028	.0000	.0000	.20	.90	.....	*

* *B. Coli* present.

Small Brook on Peabody Meadow.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1872	1904 Mar. 1.	Slight	Slight	V. slight veg.	0.15	3.30	1.80	.0006	.0030	.0000	.0000	.20	1.70	.....	..

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Chemical Examination of Water from Burton Pond.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1914	1904 May 1	None	Slight floc.	Veg.	0.3	3.20	1.60	.0030	.0104	.0000	.0000	.10	.90	.....	..
1986	May 24	Slight	Much fine	Decided veg.	0.4	4.00	1.00	.0000	.0090	.0000	.0000	.10	.40	.....	..
2125	July 5	Slight	Consid. fine	Much veg.	0.5	4.30	.70	.0000	.0164	.0000	.0000	.10	.40	.....	..
2275	Aug. 14	None	Consid. floc.	Musty veg.	0.4	5.60	1.70	.0020	.0158	.0000	.0000	.10	.40	.....	*
2364	Sept. 13	V. slight	V. slight	Decided veg.	0.35	4.20	.90	.0026	.0166	.0000	.0000	.12	1.10	.....	..

* *B. Coli* present.

Chemical Examination of Water from Blood Brook.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1871	1904 Mar. 13	None	Slight	V. slight veg.	0.15	2.70	1.60	.0012	.0054	.0000	.0000	.12	1.25	...	..
2127	July 5	Slight	Slight	Slight veg.	0.15	4.10	1.20	.0000	0066	.0000	.0000	.15	.60	.....	..
2273	Aug. 14	None	None	Musty veg.	0.15	3.70	2.30	0000	.0020	.0000	.0000	.20	.30	.....	*
2366	Sept. 13	V. slight	V. slight	Decided veg.	0.1	4.80	1.50	.0014	.0044	.0000	.0000	.17	1.40	.....	*

* *B. Coli* present.

Brook on Land of Mrs. R. W. Ward.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1870	1904 Mar. 13	None	Consid. floc. veg.	None	0.15	3.20	2.00	.0008	.0026	.0000	.0000	.18	.60	.....	*

* *B. coli* present.

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Chemical Analysis of Water from Miller Brook.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
1873	1904 Mar. 13	Slight	Slight	V. slight	0.25	3.40	1.70	.0024	.0046	.0000	.0000	.22	1.10	.....	..
1983	May 23	Slight	Slight	Much veg.	0.3	4.50	1.40	.0010	.0096	.0000	.0000	.13	1.20	.....	*
2126	July 5	Slight	Consid. earthy	Slight veg.	0.25	4.80	1.60	.0000	.0032	.0000	.0000	.10	.60	.....	..
2276	Aug. 14	V. slight	Slight floc. veg.	Slight earthy	0.25	6.00	1.50	.0020	.0064	.0000	.0000	.20	.90	.....	*
2365	Sept. 13	V. slight	V. slight	V. dec. veg.	0.1	5.20	2.70	.0010	.0044	.0000	.0000	.15	1.70	.....	*

* *B coli* present.

A large number of private supplies have been analyzed during the past two years. Of 45 well waters examined but 14 were of good quality; 10 contained either sewage or lead in such quantity that the water was reported as of doubtful quality and 21 waters were condemned as unfit for use. Twelve of those so classed were contaminated by large quantities of lead.

Twenty-six spring waters were also analyzed. Eleven were of good quality, but 15 contained so much lead that they were unsuitable for use. All of the spring waters were free from sewage, and if conveyed through some other pipe than lead would be acceptable supplies.

Winchester.—No public water supply. Two well and one spring waters were analyzed. One of the well supplies was polluted; the other two waters were of good quality.

Windham.—No public supply.

Windsor.—No public supply. Most of the water is taken from wells dug from 15 to 20 feet; soil mostly heavy loam; subsoil, clay or hardpan.

Wolfeborough.—The public water works, owned and operated by the town, were installed in 1889. The source of the supply is a pond of about 300 acres; depth in places from 60 to 70 feet; average for the pond about 32 feet; bottom mostly sand, with small rocks. The watershed is from three to four square miles in extent; five sevenths woodland, two sevenths pasture; only one family inhabits the watershed.

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Chemical Examination of Water from Public Fountain.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
842	1902 Oct. 9	None	None	Slight musty	0.0	3.90	1.40	.0000	.0068	.0000	.0000	.07	1.30	.....	..
1659	1903 Nov. 9	Slight	Fine	Slight veg.	0.0	2.90	1.40	.0010	.0056	.0000	.0000	.08	1.40	.....	..
2136	1904 July 5	None	S. fine	V. slight	0.1	2.30	.80	.0000	.0062	.0000	.0000	.15	.90	.....	..

Two well waters were analyzed and one proved to be polluted and unfit for use.

Woodstock.—In 1897 the North Woodstock Water Company installed a system of water works which was sold to the town of Woodstock. This is in the precinct of North Woodstock. The source is a stream dammed to form a reservoir of about one acre. Seventy families, 99 per cent. in the precinct, are takers. There are no wells in the precinct. The town of Woodstock is about evenly divided into the northern and southern portion. The latter is supplied with water from private wells and springs, and since the removal of all lead pipe, etc., it seems to be of good quality.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
2215	1904 July 29	V. slight	V. slight	None	0.7	5.90	1.40	.0010	.0080	.0000	.0000	.05	.70	.....	..

One spring water was found to be heavily contaminated by lead.

Woodsville (village in town of Haverhill.)—Woodsville Fire District is supplied with water by the Woodsville Aqueduct Company whose plant was installed in 1885 by James Gordon, who introduced water from Gordon spring in 1892 or 1893. The first-named supply is from Ammonoosuc River, which receives all the sewage from the towns of Bath, Lisbon and Littleton, farther up the river. The water is pumped directly from

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the river, and flows through about three miles of iron distributing mains. This company also supplies water from a spring, dug about four feet deep, which yields about 50,000 gallons daily, delivered through two miles of lead pipe. Soil is mucky loam, with sandy bottom. About nine tenths of the population are supplied from these sources. Gordon spring is about two feet deep, while the volume of water is about 48,000 gallons daily; soil, mucky loam, with sandy bottom. One half mile of galvanized iron pipe is used to convey this water. Thirty-three families take from this supply. There are 12 or 15 driven wells in the locality.

Chemical Examination of Water from Supply of Woodsville Aqueduct Company.

Number.	Date of collection.	Appearance				Residue on Evapo'n		Ammonia		Nitrogen as		Chlorine.	Hardness.	Lead.	
		Turbidity.	Sediment.	Odor.	Color.	Total.	Fixed.	Free.	Albuminoid.	Nitrates.	Nitrites.				
	1901														
17	June 3	None	Cons. floc.	Slight veg.	0.1	3.60	1.20	.0014	.0057	.0066	.0000	.13	....	.....	..
18	June 3	None	Much floc.	Slight veg.	0.1	4.10	1.70	.0046	.0093	.0066	.0000	.13	....	.....	..
19	June 3	None	Slight	Slight veg.	0.1	3.70	2.20	.0004	.0057	.0066	.0000	.13	....	.....	..
57	July 9	None	Floc. veg.	Decided veg.	0.12	5.00	2.00	.0009	.0104	.0050	.0002	.26	2.00	.....	..
58	July 9	None	None	Veg.	0.10	4.70	2.10	.0032	.0104	.0050	.0002	.20	....	.....	..
59	July 9	None	Much floc. veg.	Decided veg.	0.12	4.70	2.20	.0032	.0135	.0050	.0002	.20	....	.....	..
159	Sept. 12	None	None	Decided veg.	0.15	5.10	3.30	.0016	.0112	.0000	.0000	.19	....	.....	..
160	Sept. 12	None	Floc. veg.	Decided veg.	0.15	5.60	2.60	.0026	.0126	0000	.0000	.19	....	.....	..
	1902														
404	Feb. 13	None	V. slight	Veg.	0.1	5.80	3.40	.0006	.0070	.0200	.0000	.10	1.60	.....	..
	1903														
1022	Feb. 2	None	None	Slight veg.	0.2	4.30	1.90	.0000	.0048	.0200	.0000	.08	1.90	.....	..
1023	Feb. 2	None	None	None	0.0	7.30	3.10	.0000	.0014	.0200	.0000	.12	2.90	.....	..
1430	Aug. 11	Marked	Much fine veg.	V. slight	0.15	6.60	3.40	.0010	.0074	.0000	.0000	.15	1.80	.....	..
1749	Dec. 18	None	Slight	None	0.0	6.20	4.30	.0004	.0048	.0400	.0002	.13	2.60	.....	..
	1904														
2117	July 4	Slight	Cons. floc.	Much veg.	0.2	4.10	2.30	.0108	.0082	.0000	.0000	.15	1.80	.....	..

This water is somewhat polluted by the sewage which enters the Ammonoosuc River above Woodsville, at Bath, Lisbon and Littleton. The amount of sewage present is somewhat greater during the summer and fall, when the flow of water is the least.*

*See "The Woodsville Water Supply and Typhoid Fever," elsewhere printed in this report.

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Twelve private supplies have been examined during the past two years. Five of the eight spring waters were pure, the three polluted spring waters were evidently receiving seepage from some sewage-polluted area. Two of the three well waters were polluted by sewage. One pond water was analyzed and proved to be of good quality.

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LITTLETON EPIDEMIC OF TYPHOID FEVER AND THE PUBLIC WATER SUPPLY.

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THE LITTLETON EPIDEMIC OF TYPHOID FEVER AND THE PUBLIC WATER SUPPLY.

One hundred and thirty-nine cases reported, with 11 deaths.

During the winter of 1902–'03 Littleton experienced the greatest epidemic of typhoid fever that has occurred in the state of New Hampshire for many years—for more than a quarter of a century, at least, the outbreak being due to the contaminated water supply, which was taken from Ammonoosuc River. This calamity occurred after repeated warnings from the State Board of Health, and we give herewith a somewhat detailed report of the particulars connected with the epidemic because of its magnitude, its great importance as a lesson to other communities and, least of all, because an attempt was made to place certain local responsibility upon the State Board of Health.

On January 1, 1903, Dr. George F. Abbott, secretary of the Board of Health of Littleton, telephoned to the office of the State Board of Health that numerous cases of typhoid fever existed in Littleton village. Immediately the following letter was sent:

CONCORD, N. H., January 1, 1903.

George F. Abbott, M. D., Secretary Board of Health, Littleton, N. H.

DEAR DOCTOR:—Referring to the outbreak of typhoid fever in your town, concerning which you gave me some information by telephone this morning, I would say that I have directed that four containers be sent to you for the collection of samples of water for chemical and bacteriological examination.

If there are 30 or 40 cases of typhoid fever in Littleton, and this outbreak has appeared within a week, or two, as you state, there must be some common cause for it. In all such outbreaks we look first to the water supply, and next to the milk supply. We would like your board to make an immediate investigation along these lines; that is, find out how many persons are now having the disease; how many houses are infected and what is the source of the water supply. Should there be instances in which an infected family is not connected with the public supply, we would suggest the advisability of inquiring whether or not the patient might have drank from the public supply when away from home.

In the second place investigate the source of the milk supply. Find out how many families have been supplied from one source and whether certain infected families have cows of their own, etc.

It will take considerable time to get at the facts. Every house will have to be

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visited, and the questions should be prepared beforehand, so that the answers may be written in quickly—in fact, a careful canvass should be made of the entire situation.

With all these facts before us we may be able to come to some conclusion, or, if not, other lines of investigation may be suggested.

Furthermore, inquiries should be made as to whether there have been any cases of typhoid fever along the river above Littleton at any point within the last few months.

We shall make a most thorough bacteriological examination of the water received, but you realize the great difficulty in discovering the bacillus of typhoid fever when but very small quantities exist in great volumes of water. However, we shall take up the work promptly, and will report results at the earliest possible moment. In the meantime please gather the information asked for and make a report at the earliest possible date to this board.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

The following reply was received to the foregoing letter:

LITTLETON, N. H., January 3, 1903.

Dr. Irving A. Watson.

DEAR SIR:—In reply to your letter of January 1st would say that we have made a careful canvass of the cases of typhoid fever in town and find that there are and have been 38 cases in this town, and two more that worked in Littleton and went home sick to their homes in Bethlehem. One of our teachers went to Laconia about three weeks ago, and she is now very sick with fever. I think it was about Christmas that she was first taken sick.

Of these 38 cases in town two have recovered and three have died. One had water supply from a well and lived a mile above Apthorp; one from a spring on a hill, and lived one and one-half miles below the village on the meadows. This was a little girl and she was not much, if any, away from home. Three had spring water at home and town water in the shop. All of the others have town supply. The milk supply is more varied. Nine have milk at home, or from one cow, and the others from seven different milkmen.

Very truly yours,
(Signed) G. F. ABBOTT.

It will be seen by the above report that this epidemic was well under way before any report was made to the State Board of Health. Possibly this was due to a neglect of the attending physicians to report their cases to the local board of health, although two days prior to the receipt of any information by the State Board of Health, the local board requested that containers be sent to them for the collection of samples of water. The containers were forwarded the same day, and the samples were collected and shipped to the State Laboratory of Hygiene the following day, December 31, 1902. It is to these samples that reference is made in the following letter:

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CONCORD, N. H., January 5, 1903.

George F. Abbott, M. D., Littleton, N. H.

DEAR DOCTOR:—I wish you would try to find out just when the first case of typhoid fever in the present outbreak appeared. It seems to me that the disease must have been prevailing for some little time, otherwise you could not have had three deaths and two recoveries.

Furthermore, I wish you would ask every physician in Littleton if they have treated any case of typhoid fever in the valley above Littleton in such proximity to the river or its tributaries as might have polluted the water.

We are at work upon the first sample of water received, making bacteriological cultures and growths, and shall begin on the other samples as soon as they are received this afternoon. It will take several days to complete the work.

I may say we have very strong suspicions of the water supply as the source of infection, as we have already found the *colon bacillus* in the water.

Pending further investigations in this direction, I would suggest that you recommend to the people of Littleton that they do not use this water for drinking purposes unless it has been boiled.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

On the same day as the above, communications were addressed to H. A. Hildreth, M. D., and H. S. Pratt, M. D., Bethlehem, asking if any cases of typhoid fever had occurred in their practice in Bethlehem Hollow, or anywhere else in the Ammonoosuc valley, within three months, that could have possibly polluted Ammonoosuc River. Doctor Hildreth replied promptly, as follows:

BETHLEHEM, N. H., January 6, 1903.

Irving A. Watson, M. D., Secretary State Board of Health.

DEAR DOCTOR:—Yours under date of yesterday at hand, and in reply will say I *know* of no case of typhoid fever in the Ammonoosuc valley, and do not personally know of any such within the last six months; still there may have been cases north of here that I did not hear of.

Littleton, as I understand it, receives its water supply largely from the river, and the same river is undoubtedly used as a deposit for drainage or sewerage more or less by many places north of Littleton. The sewerage from this town does not empty directly into, or, in fact, very near the river; still it may, I suppose, some of it be carried there by surface water, but I do not *know* that it could. Apthorp, Alder Brook, Wing Road, Bethlehem Hollow, Bethlehem Junction, White Mountain House, Fabyans, Mount Pleasant House, etc., are all on the river, directly, and it is natural to suppose that more or less drainage would find its way into the river. From what I hear the epidemic is assuming almost alarming proportions. Two physicians told me there were probably more than 50 cases in Littleton. There is one case in this town, I hear,—a young lady who came here sick from Littleton. I have not seen her.

Very truly yours,

(Signed) H. A. HILDRETH.

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Doctor Pratt replied a few days later, the tenor of his letter being substantially the same as that of Doctor Hildreth.

Further investigations along this line led to the discovery of the fact that a typical case of typhoid fever occurred in Bethlehem Street, which was attended by Dr. George W. McGregor of Littleton and which he had charge of from November 23 to December 23, 1902, during Dr. H. A. Hildreth's absence from town as a member of the Constitutional Convention.

It requires no stretch of the imagination to assume that the typhoid bacilli, after being carried the length of the sewer and deposited upon the ground at the outlet of the Bethlehem sewer, were washed into Ammonoosuc River. And, still further, it is not at all improbable that there might have been one or more cases of typhoid fever in some of the numerous houses that are situated along the banks of Ammonoosuc River above Littleton, as it is a known fact that boarding houses at Alder Brook and points above discharge their waste directly into the river. Be that as it may, the course of the disease was such as to leave no doubt whatever that the cause of the epidemic was through the pollution of the public water supply, even if the typhoid bacillus had not been discovered at the State Laboratory of Hygiene in the samples of water drawn from the public supply in Littleton. Four bottles of water from Littleton, sent by the local board of health, were received at the State Laboratory of Hygiene at Concord, two of which were retained, and the other two were forwarded to the bacteriological department at Hanover, with the following letter:

CONCORD, N. H., January 6, 1903.

H. N. Kingsford, M. D., Hanover, N. H.

MY DEAR DOCTOR:—As you may perhaps know, there is an epidemic of typhoid fever in Littleton. I note that you have made one or two examinations of blood from these cases. There have been 38 cases, with two deaths and two recoveries. It was not reported to the State Board of Health until Thursday last, and it is claimed that the disease has not existed more than two weeks; but that is very improbable, to my mind, judging from the results.

In all but two instances the families in which the disease exists are using the public water supply, which, as you know, is pumped from Ammonoosuc River. The cases are scattered throughout the village, and are not confined to any particular locality, nor do there appear to be any unsanitary conditions, locally, that could account for such an outbreak. The milk supply of these families is received from nine different milkmen, and two of the families have cows of their own. I am very confident that the infection has been received through the public water supply.

We have received this morning four bottles of water from the public supply of Littleton, and have directed that two of them be sent to you this morning by express. I wish you would do some bacteriological work with it, with a view to discovering the bacillus of typhoid fever, if possible.

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We have had one sample here before this lot, and Doctor Day has been at work upon it. He has already discovered the colon bacillus. The investigation is still in progress, and he has not completed his work. I am very anxious to demonstrate, if possible, the existence of the typhoid fever germ in this water, because I believe it exists, or did exist, in the river. Its actual discovery would do much toward obtaining a better supply for the town.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

At the Concord laboratory Dr. A. K. Day, bacteriologist, readily isolated the colon bacillus. At the Hanover laboratory Dr. H. N. Kingsford, bacteriologist, after a great amount of labor and growing more than 160 plate cultures, succeeded in finding the typhoid bacillus. His report was as follows:

HANOVER, N. H., January 15, 1903.

Dr. I. A. Watson, Concord, N. H.

DEAR DOCTOR:—The bacteriological examinations of the specimen of water collected and sealed by Solon Simenels of Littleton, N. H., taken from tap at Neal McMillian's house, Littleton, N. H., shows the following: Two bottles of water in New Hampshire State Board of Health special cases. The seal on one bottle being broken, samples were taken from but one bottle, the contents of the bottle not being disturbed before the specimens were taken. Specimens were taken by means of sterile tubes, from bottom, middle, and top of water, mixed with gelatin and the plate-culture used. One tenth of a cubic centimetre of water was used in each case. After 36 hours at room temperature colonies of bacteria began to appear; the plates were allowed to stand 24 hours longer. All visible colonies were then counted, and the suspicious colonies were fished out and planted on different media. Six suspicious colonies were then taken from the specimen from the top, four from the middle section, and seven from the bottom section. One colony from the top proved to be typhoid bacilli, three colon bacilli, and two not identified; from middle section two colonies of colon bacilli, and two not identified; from bottom section, three typhoid bacilli, one colon, and three other colonies not identified.

In the identification of these bacteria the gas production in gelatin and the action of the bacteria on sterile milk was the method used. Number of all kinds of bacteria per cubic centimetre from top section about 8,000; from middle section about 6,000; and from the bottom section about 12,000. This number is rather low, as the count was taken when the colonies were only three days old.

This water is very markedly polluted and unfit for drinking purposes. If this water contained no typhoid bacilli, it would still be unfit to drink.

Very truly yours,
(Signed) H. N. KINGSFORD.

This information was immediately transmitted to the Board of Health of Littleton in the following communication:

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CONCORD, N. H., January 16, 1903.

George F. Abbott, M. D., Secretary Board of Health, Littleton, N. H.

DEAR DOCTOR:—I am now able to render to you a detailed report upon the bacteriological examination of the water collected by yourself and sent under seal to the laboratory in containers sent to you for that purpose. The specimens were divided between the two bacteriological departments, a portion of the work being done by Dr. A. K. Day, and the remainder of the investigation by Dr. H. N. Kingsford, both bacteriologists of the State Laboratory of Hygiene.

As I have already reported to you, Dr. Day very early in his examination found the colon bacillus in abundance, showing without question that the water was contaminated by fecal discharges.

Two of the containers which you forwarded to the State Laboratory of Hygiene were sent to Dr. Kingsford, with instructions to make a bacteriological examination, and I submit herewith his report, word for word, received this morning. He says: "The bacteriological examination of the specimen of water collected and sealed by Solon Simenels of Littleton, N. H., taken from tap at Neal McMillians' house, Littleton, N. H., shows the following: Two bottles of water in New Hampshire State Board of Health special cases. The seal on one bottle being broken, samples were taken but from one bottle, the contents of the bottle not being disturbed before the specimens were taken. Specimens were taken by means of sterile tubes, from bottom, middle, and top of water, mixed with gelatin, and the plate-culture used. One tenth of a cubic centimetre of water was used in each case. After 36 hours at room temperature colonies of bacteria began to appear; the plates were allowed to stand 24 hours longer. All visible colonies were then counted, and the suspicious colonies were fished out and planted on different media. Six suspicious colonies were then taken from the specimen from the top, four from the middle section, and seven from the bottom section. One colony from the top proved to be typhoid bacilli, three colon bacilli, and two not identified; from middle section two colonies of colon bacilli, and two not identified; from bottom section, three typhoid bacilli, one colon, and three other colonies not identified.

"In the identification of these bacteria the gas production in gelatin and the action of the bacteria on sterile milk was the method used. Number of all kinds of bacteria per cubic centimetre from top section about 8,000; from middle section about 6,000, and from the bottom section about 12,000. This number is rather low, as the count was taken when the colonies were only three days old.

"This water is very markedly polluted and unfit for drinking purposes. If this water contained no typhoid bacilli, it would still be unfit to drink."

It would seem that no comment on the foregoing report is necessary. The fact that an epidemic of typhoid fever has been produced in Littleton by contaminated water is settled beyond doubt. The report, together with the condition obtaining in your town, is but the culmination of what the State Board of Health has repeatedly pointed out as not unlikely to occur unless some change was made, and we submit that, being powerless to change the conditions which so seriously threaten the lives of the people and the prosperity of the town, it becomes the duty of the citizens of Littleton to take some action as promptly as possible that will prevent such a lamentable occurrence in future.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

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WHO WAS RESPONSIBLE?

An attempt was made by certain parties, first, to deny that the water-supply of the village of Littleton was not of good quality and perfectly safe to use at all times; secondly, that the existing epidemic was not typhoid fever, but *grippe*, or something of that character; thirdly, that the water company had carried out the suggestions made by the State Board of Health, and therefore if anybody was responsible it was the latter, for not having notified the public of the dangerous character of the water before the outbreak. Not all of these points rose simultaneously; but as a reminder that the people of Littleton had been forewarned of a calamity of this kind, the following letter was addressed to the Board of Health of Littleton, and we believe was at once published in the Littleton local papers:

CONCORD, N. H., January 9, 1903.

Board of Health, Littleton, N. H.

GENTLEMEN:—A careful investigation of the circumstances connected with the present epidemic of typhoid fever in the town of Littleton warrants this board in expressing the opinion that the condition of the public water supply is responsible for it. The opinion is arrived at in three ways: First, that there must have been a common cause to produce so large a number of cases almost simultaneously; second, the elimination of the possibility of the disease having been introduced through infected milk or other source sometimes responsible for such outbreaks; third, the discovery in the laboratory by bacteriological examination of the public water supply of Littleton the presence of the colon bacillus, which is due to fecal contamination. So conclusive is the evidence that it would not seem to be material to the proof of the case that the original source of infection should be discovered, or that the bacillus of the disease should be found in the water examined.

The germs of typhoid fever might have been distributed to the water supply through an unrecognized, or so-called "walking" case of the disease, or by a person sufficiently convalescent to be able to travel about.

A special report on an outbreak of typhoid fever at Woodsville and the pollution of Ammonoosuc River was made to the boards of health of the towns along the Ammonoosuc valley, including Littleton, some two years ago, and was published in Volume 16 of the reports of this board. The case was presented as forcibly then as it can be now. It is not necessary to review that report, but a few quotations from it are pertinent in the present situation. Among other things is said, referring to Ammonoosuc River, "It should be remembered that this is a comparatively rapid stream, and in all probability the germs of typhoid fever might be carried its entire length intact and capable of communicating the disease to persons who might drink of the water." . . . "The total amount of sewage poured into the river is quite large, and the dejecta of a single case of typhoid fever discharged into the stream at any point in its course under favorable circumstances might readily infect the river its entire length below." . . . "On both sides of the river are numerous dwellings, boarding-houses, stables, etc., the waste from which goes directly into the river. The condition

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at Alder Brook, with its sawmill, boarding-houses, etc., is, of itself a constant menace to the purity of the water supply. Further along up the river sewage is received from Wing Road, Bethlehem Hollow, and numerous mountain houses, the last being Crawford House at the very head waters of the river. At Bethlehem Hollow some of the boarding-house privies are located directly over the river, and this is not the only place where similar conditions exist. At least the leachings of the sewage of the village of Bethlehem, with its 3,000 or more summer boarders, must enter the river, especially in the fall of the year, when the rains are more numerous and after a season's collection of sewage on the ground, where it is deposited on a slope inclining toward the river." . . . "A single case of typhoid fever at any point where the discharges would be sewered into the river might produce an epidemic of this disease at Littleton or Woodsville, the only two towns along the river which take this water for public uses." . . . "The use of the water for domestic purposes should be abandoned, unless it can be effectually filtered. This view is taken because we cannot see any way by which the stream can be protected against conditions more or less dangerous. To exclude sewage from this river would require an outlay of several hundred thousand dollars, with unsatisfactory results and only a limited protection. It would, therefore, seem that the only safe and feasible plan is for Woodsville and Littleton to secure drinking water from some other source, or to construct scientific filter beds, and to surrender the river to power and drainage purposes."

After narrating some serious outbreaks of typhoid fever which have occurred in the past through water contamination, the report goes on to say: "*Under existing conditions the public water supply of Littleton and Woodsville is liable at any time to be infected in a similar manner, with like results.*"

In referring to some previous outbreaks of typhoid fever in Littleton and to the opinion that had been expressed by some of the physicians that it was caused by contaminated water, the report says: "There are many circumstances that point very strongly to this conclusion; but proof of this is not material or necessary to render emphatic the assertion that this river water is unfit for drinking purposes, *and that from its use individual cases or an epidemic of typhoid fever is liable under certain conditions to be developed at any time.*"

It is not necessary to quote further. Enough has been cited to show that the dangers have been prominently and specifically pointed out to the Littleton Water and Light Company and to the public, and this more than two years ago. Still, no efforts have been made that have been of any material benefit to the community. In October, 1899, a conference was held at Littleton between two representatives of the State Board of Health and the consulting engineer of the Littleton Water and Light Company. After examining the situation, the engineer, for the company, proposed to sink a certain number of wells a reasonable distance from the river, from which to pump water, and to abandon direct communication with the river water, which proposition was assented to by the representatives of this board, and allowing reasonable time to demonstrate its success or failure. The general proposition, understood to have been acceptable, was never carried out; but some make-shift changes, practically valueless, are reported to have been made.

The chemical analyses made at the State Laboratory of Hygiene have shown the water of Ammonoosuc River to be naturally and organically good, and that it does not carry an amount of contamination recognized chemically to class it

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other than good. The sewage which is deposited in the river is rapidly destroyed as such, while disease germs, being minute, living bodies, are carried long distances unchanged, and, moreover, are never recognized by chemical analysis. It should, therefore, be understood that a water reported to be chemically good is not ensured against the presence of disease germs.

The State Board of Health has ample authority in some directions, but it is absolutely powerless in a case like this, and the local board of health is equally so. Unless conditions are changed the calamity which is now upon Littleton may be repeated at any time. The situation is such that the citizens of Littleton must take this matter in hand and bring about at the earliest possible moment a solution of the problem of obtaining a water supply for the town that shall at all times be free from danger to its citizens.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

On January 17, 1903, a public meeting of the citizens of Littleton was held for the purpose of considering some means of securing a safe water supply. The attendance was large, but the State Board of Health was not represented. According to the report of the meeting in the public press, it transpired that the State Board of Health, and particularly the State Laboratory of Hygiene, were severely criticized by those interested in the Littleton Water and Light Company, to which sentiment support was given by a representative of the local board of health, either through a misinterpretation of laboratory reports, or to divert attention from alleged shortcomings of the board.

So unreasonable and misleading were some of the statements at that meeting, the following statement was given to the public:

LITTLETON WATER SUPPLY AND THE STATE BOARD OF HEALTH.

At a public meeting of the citizens of Littleton, held January 17, 1903, for the purpose of devising some means whereby that town might be furnished a public water supply that would not endanger the health and lives of the consumers, certain statements are reported in the public press to have been made concerning the State Board of Health and the State Laboratory of Hygiene that are so at variance with the facts, or so misrepresent the situation, that we feel compelled to consider as publicly a few of the allegations.

1. In the summer of 1899, after the outbreak of typhoid fever at Woodsville, and a warning to Littleton of what might be expected in that locality, Hon. James W. Remick wrote the attorney of the company, William B. Hord, Esq., in New York, that the public welfare required that the company should furnish a better water, and upon receipt of this letter the consulting engineer of the company, Mr. Edgar L. Street, went to Littleton, looked the situation over, and made a report, Mr. Hord, in reply to Mr. Remick's letter, quoted from Mr. Street's report, which, after admitting the danger of contamination, said: "The pump house stands on the bank of the Ammonoosuc River, and the pump draws water directly from the river. Surrounding the river is a level field, one

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side of which forms the bank of the river. The formation of the soil of this field is sand and gravel, and its depth is about 25 feet. Under this bed of gravel lies hard rock. It was found that the water in the gravel stands at about the same level as the water in the river, when tested about 50 feet from the water's edge. This being the case, we have a bed of water-bearing gravel, from which a large supply of thoroughly filtered water may readily be drawn by the usual method of putting down *a series of tube-strainer wells* to the depth of the rock." (See page 33, Sixteenth Report of the State Board of Health.)

It should be noted that Mr. Street proposed a "series of tube-strainer wells to the depth of the rock." A few weeks later, by agreement, a conference was held between Mr. Edgar L. Street, consulting engineer for the company, Prof. Robert Fletcher, C. E., engineer for the State Board of Health, and the secretary of the board. It was finally agreed that four wells should be sunk in the gravel in the manner proposed by Mr. Street, at a reasonable distance from the river, which proposition was fully agreed to by the representatives of the State Board of Health as an experiment. (See page 34, Report of the State Board of Health, 1900.)

If the four wells mentioned have been sunk in the gravel to bed rock, so far away from the river as not to draw directly from it, properly piped and pumped from, then the agreement has been carried out. We have been informed by creditable persons that no such thing has been done. That a pumping pit, instead, near the river and quite remote from the proposed "series of wells," was made, and, like every temporary expedient of this kind, soon became a failure, for obvious reasons.

2. The samples of water which have been received from the Littleton water supply from Ammonoosuc River and analyzed at the State Laboratory of Hygiene during the past year and a half, and prior to the outbreak of the present epidemic of typhoid fever in that town, proved to be chemically good—that is, they did not contain a quantity of solids, nitrates, nitrites, chlorine, etc., sufficient to exclude them from the class of "good water."

3. The allegation that no bacteriological examinations had been made until the present epidemic is absolutely false. Repeated bacteriological examinations have been made of these waters sent from Littleton from time to time for the purpose of isolating the colon bacillus, the presence of which is always considered evidence of fecal contamination; but in no instance was it found until after the present epidemic had appeared. Without doubt this water is ordinarily free from disease germs, but under the existing conditions it is liable to receive them at any time.

In waters suspected of sewage contamination it is the custom to make bacteriological examinations at the laboratory, but no record of these examinations is kept unless something is found to report. Not finding any dangerous germs in the Littleton water, no report was made upon the bacteriological work when the chemical analysis was reported to the Board of Health of Littleton. It will be seen, therefore, that the allegation that no bacteriological examinations were made was purely an assumption because no record showing the results had been reported to the Littleton Board of Health.

The State Board of Health has warned the people of Littleton that the Ammonoosuc River water, if used for domestic purposes, is a constant menace to the health and lives of the community, and that an epidemic of typhoid fever is liable to follow at any time. It has come.

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It is doubtful if an analysis of the water of Ammonoosuc River, even if made daily, would avert such a calamity. It might be that in an hour's time the germs that caused the outbreak might all have passed a given point in the river, leaving the water above in its normal condition. Chemical and bacteriological analyses can only reveal the condition of the particular sample examined. They do not show what the condition of a river like the Ammonoosuc may be in an hour, a day, or a week after the examination of the specimen received.

It seems rather an anomalous situation that the State Board of Health, after having made a very complete examination of Ammonoosuc River, and reported upon it *in extenso*, having warned the people of Littleton that the water was unsafe to drink, and having done everything in its power to induce the water company to carry out arrangements that might ensure a safe supply, should have been a target for public criticism, even by the friends of the water company in their weak attempt to defend a condition that has already brought most serious results to a large community.

(Signed) IRVING A. WATSON,
Secretary.

Concord, N. H., January 27, 1903.

Following the report of the meeting referred to and the publication of the foregoing statement, the State Board of Health received assurances from numerous prominent citizens of Littleton that the criticisms made at the meeting referred to were an injustice to the board. One of the prominent residents of that town, in a communication under date of January 29, 1903, said: "Personally I will say that it seemed to me that the criticisms of your department were unfounded and uncalled for, as you certainly outlined the situation plainly enough several years ago. The position that you take is exactly the one that I have taken in conversations several times during the last week, that it was utter nonsense to expect the State Board of Health to stand on the banks of this river above the pumping station and be ready when the first typhoid bacillus floated in sight to shout, 'Here they come, look out for them!' That, apparently, was what some people expected. The situation here, however, is bad enough as it is, and I have refrained from stirring it up any more."

At this time, Mr. Street, consulting engineer of the Littleton Water and Light Company, sent the following communication:

NEW YORK, February 5, 1903.

Irving A. Watson, Esq., Secretary State Board of Health, Concord, N. H.

DEAR SIR:—I have just returned from an extended business journey in the West, and have before me information which has been placed at my disposal concerning the deplorable epidemic in Littleton.

I expect to be in Littleton in the course of a few days for the purpose of conferring with the local manager and with the citizens as to the best course to pursue to meet this problem. Without going into details there have been in the past some very hard problems for the company to handle, on account of the

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wholesale waste of water in Littleton and the unfriendly attitude of certain influential citizens of Littleton, which has extended over a long period of years.

Recently this waste has reached a point where it became impossible with the present filtering systems to supply the demand, and for this reason we have lately been pumping to some extent directly from the river, under an agreement with the local board of health that this should only be done after due notice to them. Whilst I am not prepared to say that this direct pumping is the cause of the present epidemic, nevertheless it is the idea which first occurs to me in explanation, and before condemning the system of filtration which has been adopted, I am anxious, not only in the interests of the company, but in my own interest, to satisfy myself that the good results at first achieved are no longer realized. In order to get at the truth about this, it seems to me that the best way is to have a daily sample of water taken from the collecting well at the lower pumping station, which sample should be analyzed for impurity under your direction in Concord. If this was carried on for a considerable period of time it seems to me that we should know what to expect from this source of supply. If proper measures are taken to check the waste of water in Littleton, the present consumption, without any inconvenience to the citizens, can be reduced 50 per cent., and the problem of keeping up the supply would then be a comparatively simple one.

I expect to be in Littleton on Sunday and Monday, and would be much obliged if you would write me in care of the Water and Light Company.

I notice from the published correspondence which has been forwarded me from Littleton that there has been some misunderstanding among the members of the State Board of Health about the attitude of the company towards the method of analysis adopted by the board. This is all based on a misunderstanding, and we certainly have no fault to find, since the results reported were such as we anticipated, and were uniformly satisfactory to the citizens.

Yours truly,

(Signed) EDGAR L. STREET.

Mr. Street was replied to as follows:

CONCORD, N. H., February 9, 1903.

Edgar L. Street, C. E., 44 Wall Street, New York.

DEAR SIR:—I am in receipt of your favor of February 5, and note its contents. I can scarcely see any good reason why further advice or aid should be asked from the State Board of Health by your company in the light of past experience, since the specific recommendations made have not been carried out at all. Advice which is not heeded is sometimes worse than useless, as it seems to have been in this particular case, inasmuch as it not only accomplished nothing, but proved to be retroactive in its nature, judging from the amount of misrepresentation, if not abuse, that has been heaped upon the State Board of Health in its endeavor to give your company and the citizens of Littleton the best possible advice in the matter.

I am of the opinion that both of your collecting wells are located too near the river, so that the river water that enters them is not properly filtered. But even if that is a debatable question, the proposition which you make to have the water from the lower collecting well analyzed daily at the State Laboratory of Hygiene would not be feasible, as the results could not be obtained in season to make any

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change as promptly as the public demand, or as would be necessary to afford protection. It would be necessary to extend the bacteriological examinations over many months, or a year perhaps.

I do not wish you to understand that the State Board of Health is not willing to do everything in its power to assist the citizens of Littleton in their efforts to secure a water supply that shall be free from danger; but we feel that it devolves upon your company to present some definite and positive plan which you will agree to carry out, when we will give the matter such consideration as comes within the province of this board.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

Mr. Street, in his brief reply to the above, said: "I accept your suggestions with pleasure, that your further action had better be deferred until such time as the company has its plans perfected."

MAGNITUDE OF THE EPIDEMIC.

The following table was compiled from the weekly reports of Dr. George F. Abbott, secretary of the Board of Health of Littleton:

TYPHOID FEVER AT LITTLETON.

Compilation of reports made by Dr. G. F. Abbott, Secretary Board of Health.

Date of Reports.—1903.	Number sick at last report.	Taken sick.	Recovered.	Died.	Number sick at close of week.
January 3		38	2	3	33
January 10	33	21	2	2	50
January 17	50	9	4		55
January 24	52	13	13		52
January 31	52	23	16		59
February 7	59	11	13	2	55
February 14	55	13	5	1	62
February 21	62	8	26	1	43
February 28	43	3	8	2	36

It will be seen that there is an error in the report of January 17 or that of January 24. In the latter the number of cases given as existing at the time of the last report was 52, while the previous report gave the number as 55, a discrepancy of three.

The total number of cases reported was 139, with 11 deaths. It is not probable that these figures represent all the cases that occurred. How many there were that were not reported to the local Board of Health,

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cannot be ascertained. Neither does this table include some cases that were contracted in Littleton but developed elsewhere.

The map of the village of Littleton, herewith given, and which may be considered as probably approximately correct, shows the location of the pumping station at Apthorp, the water pipes, which are represented by the broken lines through the middle of the streets, public buildings, residences, and the houses, marked with a cross, in which cases of typhoid fever occurred. It will be seen from the latter that the disease was distributed through all parts of the village.

Dr. H. N. Kingsford and E. H. Hunter, C. E., of Dartmouth College, visited Littleton for the purpose of obtaining data upon which to construct the map referred to, and it was drawn by Mr. Hunter.

In transmitting the map to the board, Dr. Kingsford said:

HANOVER, N. H., August 4, 1904.

I. A. Watson, M. D., Concord, N. H.

DEAR DOCTOR: — In reply to your letter I am sending you the facts in connection with the Littleton typhoid epidemic. I am sending you a map showing the three different stations from which water was supplied to Littleton. The broken lines represent water pipes; the crosses indicate the houses where most of the cases occurred. The pipes are continuous, so when the pressure is low at the river the water is supplied from the Oak Hill reservoir, which is spring water and 256 feet above Main street, comes down into the lower part of the town.

As you know, the method of taking water from the river was a number of wells situated from 20 to 50 feet from the river, the water from the river filtering through sand into the wells, from which it was pumped into the mains.

It was found that the sand had become clogged, and the wells did not contain water enough to supply the needs, so, unknown to the town authorities (?), the water company placed pipes running directly from the river into the wells, so the water was pumped into the supply pipes without any filtration whatever.

I found that the typhoid cases were scattered pretty much over the town, but, as you will see from the crosses, which show where the cases occurred, they were for the most part in the lower part of the town, where they got river water, or river water mixed with spring water.

We found where there were three cases that were not connected with the town supply, but the surroundings were such they could not help getting infected from flies or other agencies. I also learned that there had been a case of typhoid fever a short way up the river from the upper dam, and that the people discharged practically everything into a small stream which emptied into the river; also that the individual had been ill about two weeks before medical advice was called, and that the epidemic occurred at about that time, so you can see how easy it was for the water supply to become infected. I also found that there was some suspicion among the people in town that the sewer leaked in some places; but could find no proof of it.

The map is not a very good one, but will illustrate the principal points.

We know that there were a number of cases of typhoid fever in Littleton;

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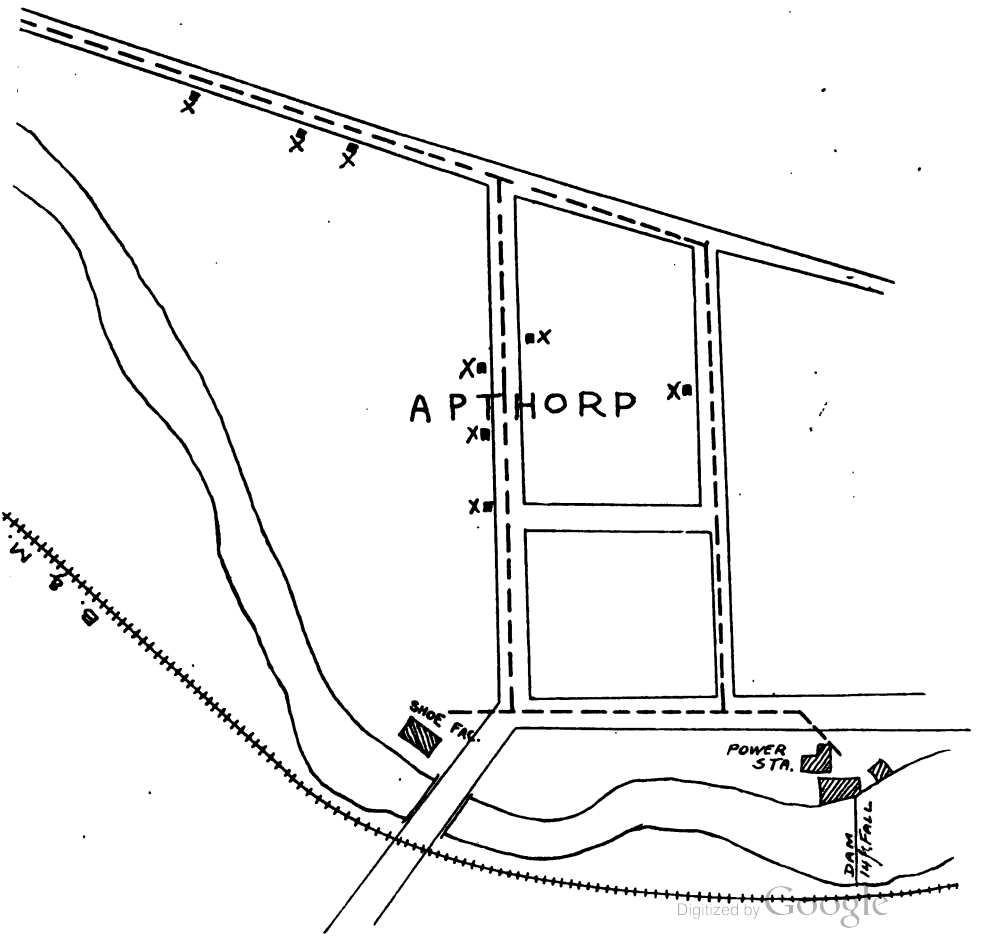

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we know the water contained typhoid bacilli; we know that the water was taken directly from the river and sent into the pipes without filtration; we know there was a case of typhoid fever a short distance up the river—all of which facts are to my mind conclusive evidence that the water was the cause of the epidemic.

Yours very truly,
(Signed) H. N. KINGSFORD.

LABORATORY PROOFS OF TYPHOID FEVER.

Allusion has been made elsewhere to the attitude of certain parties during the earlier part of the epidemic in alleging the cases were not typhoid fever, but *grippe*, or something of that character. Communications upon this point were received by the board. A prominent citizen of Littleton wrote that the friends of the water company contended that there was no typhoid fever, and that the doctors were improperly diagnosing the cases. He suggested the propriety of the State Board of Health's sending an expert to examine the cases, as it was important that the question should be definitely settled, and stated that if the water supply was contaminated and liable to injure public health at any time, a remedy must be sought. The reply of the board to this communication was that, as forty cases had already been reported as typhoid fever, these presumably occurring in the practice of all the physicians in the town of Littleton, the board would not feel warranted in sending an expert to examine the cases, as the unanimous opinion of the attending physicians was conclusive.

Notwithstanding that the board entertained no doubt as to the character of the disease, it was thought best to ask for some specimens for examination at the State Laboratory of Hygiene. This was done as follows:

CONCORD, N. H., Jan. 12, 1904.

George F. Abbott, M. D., Secretary Board of Health, Littleton, N. H.

DEAR DOCTOR:—I am sending to you by express this morning some outfits for typhoid fever specimens upon which to make the Widal test.

As it has been alleged that typhoid fever does not exist in Littleton, it seems to me that it would be well to corroborate the diagnosis of the physicians by applying the test. Dr. McGregor is the only person who has sent specimens for this test to the laboratory.

Will you see some of the physicians and ask them to forward specimens to the laboratory, giving them as many outfits as they may require. If you have not enough outfits, will send more.

While I have no doubt whatever of the correctness of the diagnosis of the Littleton physicians, still, in view of the fact that the existence of the disease has been denied, I think it advisable, for certain reasons, that the examination be made.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

This letter produced no results.

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Three of the physicians of Littleton, to wit, Dr. G. W. McGregor, Dr. J. M. Page and Dr. W. C. E. Nobles, who were by this time availing themselves of the services of the State Laboratory of Hygiene for diagnostic purposes, continued to send specimens; but none were received from any of the other physicians of that town.

Following is a tabulation of the results of the examinations referred to, giving laboratory number of case, date, and result of test. The minus (—) sign stands for negative, and the plus (+) for positive result.

RESULTS OF BLOOD EXAMINATIONS IN THIRTY-TWO CASES OF SUSPECTED TYPHOID AT LITTLETON.

Date.	Laboratory number of cases.	Reaction.	Date.	Laboratory number of cases.	Reaction.
1902.			1903.		
December 26.....	64	—	January 22...	84	—
December 30.....	66	+	January 25...	75-2	+
December 31.....	67	—	January 25...	85	—
December 31.....	68	+	January 25...	86	+
1903.			January 27...	88	—
January 7.....	67-2	—	January 28...	89	—
January 7.....	69	—	January 31...	91	+
January 11.....	72	+	January 31...	92	+
January 18.....	73	—	February 2..	85-2	+
January 18.....	67-3	+	February 2..	93	+
January 18.....	74	—	February 2..	94	+
January 18.....	75	—	February 3..	95	+
January 18.....	76	+	February 16..	96	+
January 18.....	77	+	February 16..	97	+
January 19.....	78	+	February 16..	98	+
January 19.....	79	+	February 16..	99	—
January 20.....	64-2	—	February 17..	100	+
January 20.....	80	+	February 21..	101	—
January 20.....	81	+	March 6.....	102	—
January 20.....	82	+			

An examination of the table shows that 38 blood specimens, taken from 32 patients, were subjected to the Widal test, resulting in a positive reaction in 23 cases (showing that the disease was typhoid fever), and negative in nine cases.

The negative results by no means excluded typhoid fever, as physicians

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will understand. In the earlier stages of the disease the Widal reaction is often not obtainable. It is probable that if successive examinations had been made in the negative cases a positive reaction would finally have resulted in most, if not all, of them.

A REVIEW IN BRIEF.

1. The cause of the epidemic was a sewage-polluted, typhoid-infected water supply.

2. The State Board of Health predicted an outbreak of this character in a special report made to the water commissioners and to the local board of health at Littleton, September 29, 1899, and in Volume 16 of the Biennial Reports of the State Board of Health.

3. The Littleton Water and Light Company agreed to make certain changes to guard against such a calamity as occurred, but failed to do so.

4. As the water was furnished by a private company, the most of whose stock was held outside of the state, the citizens of the town were powerless to remedy the threatening situation.

5. The State Board of Health at that time had no authority to act, and its recommendations proved valueless because they were not carried out.

6. Results: One hundred and thirty-nine reported cases of typhoid fever, with 11 deaths.

A NEW WATER SUPPLY FOR LITTLETON.

The citizens of Littleton are progressive, public spirited, and zealously considerate of all measures appertaining to the prosperity and welfare of the town. This is evidenced in the many public and private improvements in recent years.

It was, therefore, to be expected that they would not allow a second calamity in the nature of a typhoid-fever epidemic through the continued use of a dangerous water supply.

The old Littleton Water and Light Company was financially unable to furnish a new supply, its stock being worthless and the property being practically owned by the bondholders. Town meetings were held, committees appointed, proposals finally agreed to, and the town voted to purchase the entire property of the company, and to secure a water supply of unquestionable purity. No delays were allowed, no procrastination of effort tolerated, and in a few months a new supply, taken from a stream more than ten miles distant in the midst of a mountain region, beyond the dangers of an inhabited watershed, was secured to the people of Littleton.

We commend the energetic action of that community in ignoring all uncertain propositions, and in consummating an undertaking that safe-

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guards the health of its citizens, and adds, immeasurably, to the prosperity of the town. Some of the features of the new supply have been furnished by Hon. D. C. Remich, who was one of the commissioners to construct the works:

1. The Littleton Water and Light system is owned by the town.

2. It is 10½ miles from where we connect with the old system to our new intake, which is at the base of Mt. Garfield, which is in the wilderness and at least two miles easterly of any habitation.

3. The main pipe at the intake is 16 inches for a short distance, then for five miles it is 12 inches, and the balance of the distance to our reservoir, which is a mile east of the village and 280 feet above it, is 10 inches. From the reservoir to the village the pipe is 12 inches.

4. No sewerage of any description can get into the water supply, because there are no inhabitants above our intake. The old reservoir on Oak Hill is still in use for fire purposes.

5. We believe that we have one of the best water and light systems in New England. Our supply of water is ample for a population of 30,000, and is absolutely pure, and is giving entire satisfaction to the people. It has cost us about $215,000, which money was obtained by the issue of $200,000 of 3½ per cent. bonds, and there is a floating debt outstanding of about $15,000. We expect to be able to liquidate this indebtedness at the rate of at least $5,000 per year from the surplus earnings of our plant, after paying all operating expenses, fixed charges, and also reasonable extensions.

The foregoing report on the typhoid fever epidemic in Littleton is given somewhat in detail for its instructive lesson to other communities where conditions exist that jeopardize the public water supply. It shows the danger that is always present where there is a liability of contamination, even though the water may be normally of good quality, as is Ammonoosuc River.

A stream, pond, or reservoir that supplies the public with drinking water, into which sewage from human sources may be discharged, is a constant menace to the public and should not be allowed to exist.

Not the least important lesson to be learned from the experiences recorded is the illustration of how an aroused and determined community, when beset by a great misfortune, can surmount what, before, seemed insuperable obstacles.

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THE WOODSVILLE WATER SUPPLY AND TYPHOID FEVER.

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THE WOODSVILLE WATER SUPPLY AND TYPHOID FEVER

For more than five years the State Board of Health has, almost without cessation, been warning the people of Woodsville against the use, for domestic purposes, of the water furnished that village by the Woodsville Aqueduct Company. The supply is pumped from Ammonoosuc River without any effective filtration. It has already more than once been the source of typhoid infection of a fatal character. Indeed, so conclusively has this been demonstrated, that no exception to the statement is taken by the public or by the water company itself.

An outbreak of typhoid fever, with 14 cases and four deaths, occurred in Woodsville in March and April, 1899, a report of which was published in Vol. 16, Report of the State Board of Health, page 21. In the report referred to something of the extent of the pollution of Ammonoosuc River was shown as follows:

Between the 29th day of March and the 8th day of April, 1899, there occurred 14 cases of typhoid fever in the village of Woodsville, of which four proved fatal. The sudden outbreak, with no previous cases in town, was sufficiently alarming in itself to attract the immediate attention of the health authorities, and therefore a careful and studied investigation was made to discover the source of infection.

The cases were located in different sections of the town, with only one case at any given house, and with no local unsanitary conditions sufficient to account for the outbreak. In fact, the sanitary conditions were as good as the average in the community.

There are in Woodsville two sewer systems, one trapped, the other open. Some of the infected houses were connected with one system, others with the other, while some were not connected with either system.

The milk supply for these families was obtained from, at least, six different sources,—in fact, all common avenues of infection were eliminated, with the single exception of the public water supply. In this connection it may be stated that during the preceding year, 1898, 15 cases of typhoid fever were reported from Woodsville to the State Board of Health, and one in January, 1899. In previous years there has been more or less of this disease, and for a long time the public water supply has been under suspicion to the extent that many families have been supplied regularly with spring water for drinking purposes.

The present water supply was installed by the Woodsville Aqueduct Company in 1885, the water being taken directly from Ammonoosuc River at a point close to the village of Woodsville. No attempt was made to filter the water

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other than to strain out the coarser floating material. The water is forced into the service pipes by a pump operated by water power, automatically controlled so as to maintain an approximately even pressure upon the pipes, thus giving sufficient force for hydrant purposes, with, of course, an abundance of water.

. . . . . .

So far as the question of sewage is concerned, a large quantity is poured into the river. It should be remembered that this is a comparatively rapid stream, and that in all probability the germs of typhoid fever might be carried its entire length intact and capable of communicating the disease to persons who might drink of the water.

Independently of the numerous farmhouses that dot its banks or are in close proximity to the river, above Woodsville are villages, hamlets, and public hotels, to wit: Bath, Lisbon, North Lisbon, South Littleton, Littleton, Alder Brook Mills, Wing Road, Bethlehem Hollow, Twin Mountain, Fabyan, Mount Pleasant and Crawford houses. The total amount of sewage poured into the river is quite large, and the dejecta of a single case of typhoid fever discharged into the stream at any point in its course, under favorable circumstances, might readily infect the river its entire length below.

At Bath some drainage enters the river, but at Lisbon almost the entire sewage of the town goes directly into the stream. In addition to that, garbage and waste of all kinds are dumped into the river, so that it may be said that substantially all of the sewage, street washings, garbage and other waste material are discharged or thrown directly into the river.

Upon the appearance of the epidemic of typhoid fever at Littleton the authorities at Woodsville were immediately notified of the situation, as follows:

CONCORD, N. H., January 5, 1903.

Board of Health, Woodsville, N. H.

GENTLEMEN:—We deem it our duty to call your attention to the fact that there exists at the present time an epidemic of typhoid fever at Littleton, there being thirty-five cases of the disease at the present time in that town.

We believe that this condition of affairs endangers your water supply that is pumped from Ammonoosuc River to such an extent that its use for drinking purposes, unless it is boiled, should be prohibited for some time,—weeks, and perhaps months.

We believe it to be your duty to notify all consumers of this danger, which will certainly continue until after the snow and ice are carried away by the spring freshets, and perhaps longer. We believe that the danger which confronts the people of Woodsville from this source is by no means imaginary, and that unless the warning is heeded, serious consequences will follow.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

The above letter was published in *The Woodsville News*, January 9, 1903, by order of the local Board of Health, for the information of the water takers and the public.

A request was received from Health Officer A. H. Leighton, asking for

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500 pamphlets on "The Restriction and Prevention of Typhoid Fever," for the purpose of distributing one to each family in Woodsville. He further said, "Is there not something that you can do to help us about our water supply in this place? It seems to me as though if we had the support of the State Board of Health we could have some legislation this winter on our water supply that would compel our water company either to put in a better supply, or else go out of the business."

The following communication was sent in reply:

CONCORD, N. H., January 25, 1903.

A. H. Leighton, Health Officer, Woodsville, N. H.

DEAR SIR:—Your postal card received. I am sending to you by express today some five or six hundred copies of the pamphlet on "The Restriction and Prevention of Typhoid Fever." We no longer have placards for this disease.

I do not know in what way we can materially help you to avert the danger from your water supply. We have already asked you to notify water takers that if water from Ammonoosuc River is used for drinking purposes it should be boiled in every instance.

There is no law whereby the State Board of Health can compel the company to obtain water from another source. You say that it seems to you that if you had the support of the State Board of Health you could secure some legislation to improve the situation. I would say that you have the support of the State Board of Health in any effort to secure a better water supply for Woodsville.

We warned the people of Woodsville and Littleton, as you know, two years ago, in the report of this board, that an epidemic of typhoid fever was liable to appear in either of these places at any time. It has come at Littleton, and certainly will at Woodsville if Ammonoosuc River water is used for drinking purposes. We would respectfully ask you to keep the facts constantly before your people that, in order to escape typhoid fever, they must not drink water pumped from Ammonoosuc River unless it has been boiled. The river will, at best, remain in a dangerous condition for months, as you can readily understand.

If there is any way in which we can assist the citizens of Woodsville in securing a better water supply, we will gladly use every effort in that direction. The present conditions should be remedied, and until they are you will be liable to serious trouble at any time.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

The following communication was transmitted to the superintendent of the water company:

CONCORD, N. H., February 5, 1903.

George E. Cummings, Superintendent Woodsville Aqueduct Company, Woodsville, N. H.

DEAR SIR:—Under date of January 5 we notified the Board of Health of Woodsville that an epidemic of typhoid fever existed in Littleton that would

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endanger the water supply of Woodsville to such an extent that it should not be used for drinking purposes unless boiled, and asked that board to notify all parties interested of the conditions and of the requirements necessary to protect the people of that vicinity.

Since that date some 14 cases of typhoid fever have been reported in Woodsville, showing that the danger predicted was not imaginary, and that sufficient precautions have not been taken in all cases to prevent infection. We assumed that the health officer of Woodsville would promptly notify your company of the advice received from the State Board of Health, but in view of existing conditions and the probability that the water of Ammonoosuc River at Woodsville will be infected with typhoid germs for several months to come, we would respectfully suggest that your company take this matter in hand, if you have not already done so, and use every means possible to avert the threatened serious public calamity.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

After the above letter was dictated a telephonic communication was received from Mr. Cummings stating that he was just issuing a warning to the people of Woodsville against the use of water furnished by the Woodsville Aqueduct Company for drinking purposes until it had been boiled, and stating that if they did not heed the warning it would be at their own peril.

The reply was as follows:

WOODSVILLE, N. H., February 6, 1903.

Irving A. Watson, Esq., Secretary of the State Board of Health, Concord, N. H.

DEAR SIR:—I beg to acknowledge receipt of yours of the 5th, and I have distributed to all water takers at this place a circular, copy of which I attach. I have not undertaken a house to house visitation to distribute these to tenements, but have sent one of the circulars to every person who pays us for water, and have posted copies at all of our public drinking faucets belonging to the Boston & Maine Railroad.

It seems to me that this is all that we can do. This week's paper will also publish the notice. The local board of health had published in our paper here some weeks ago a notice practically the same as this, but there are some people, you know, who persist in doing what they ought not to do in spite of every warning. On the whole I think the matter is being handled as well as it can be here.

Yours truly,
(Signed) G. E. CUMMINGS,
Superintendent.

Inclosed in the foregoing letter was a copy of the notice referred to, which was as follows:

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OFFICE OF THE

WOODSVILLE AQUEDUCT COMPANY.

WOODSVILLE, N. H., February 5, 1903.

To all Water Takers:

We are this date notified by the State Board of Health that on account of the typhoid fever epidemic in Littleton, the water supplied by the Woodsville Aqueduct Company is unfit for drinking purposes unless the water has been boiled.

G. E. CUMMINGS,
Superintendent Woodsville Aqueduct Company.

Under date of February 5, 1903, the secretary of the board wrote the health officer of Woodsville, asking for a copy of the notice which he had sent out to the people of Woodsville recently in relation to the public water supply of that village. Following is his reply:

WOODSVILLE, February 7, 1903.

Dr. I. A. Watson, Secretary.

DEAR SIR:—Yours received asking for notices sent out in regard to the use of the Woodsville Aqueduct Water Company's water taken from the Ammonoosuc River. We had your letter to us printed in the *Woodsville News*, which we thought would be heeded quicker than a notice from the local board of health, as some of the people think us cranks on this water question, but have an idea that anything the State Board does or says must be right. I have also been to the houses of those who do not receive the *Woodsville News* and told them to boil the water before using for drinking purposes. I send you a copy of the paper containing the letter to us; also a copy of the notice just published by the water company.

Yours truly,
(Signed) A. H. LEIGHTON,
Health Officer.

At the April, 1903, meeting of the State Board of Health the Woodsville situation was thoroughly canvassed. The following is an extract from the records of that meeting:

Attention was called to an act of the last Legislature giving the State Board of Health authority to prohibit the use of contaminated public water supplies. The secretary suggested that this act placed a responsibility upon the board which could not be allowed to pass unheeded in connection with the water supply of the village of Woodsville, and that, in view of facts already in possession of the board, some action should be taken. It was suggested that it would be better to take the matter up with the water commissioners of that place, to see if the necessary changes might not be brought about in an amicable way, and without resort to legal action. It was suggested that the secretary take the matter in hand and communicate with the proper authorities, and to report results of his efforts at a subsequent meeting of the board.

The following extract from the records of the board shows all that was accomplished, directly, by the interview with the president of the Woodsville Aqueduct Company:

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In accordance with recommendations made at the January, 1903, meeting of the board, the secretary arranged an interview with Mr. George E. Cummings, superintendent of the Woodsville Aqueduct Company, at the office of the State Board of Health, at which time were present Mr. Cummings, Dr. G. P. Conn and the secretary. The whole situation was carefully gone over and thoroughly considered. Mr. Cummings stated that it was an admitted fact that the water supplied by his company from Ammonoosuc River was unfit for drinking purposes, and that the company had notified its patrons to that effect, and had dissuaded them from its use as far as possible; that many families were supplied with water from springs outside the village; that a public supply from a spring had been installed near the school house, and that efforts had been made as far as could be to supply the people with a drinking water other than that furnished by his company. Mr. Cummings was of the opinion that it would cause great hardship to the community to prohibit the company from delivering the water for certain purposes, like, for instance, sprinkling lawns, washing carriages and the like, outside of supplying it for drinking purposes; that it was not probab e that sufficient money could be raised to install a new public water supply for the village. Mr. Cummings stated that the company was willing to do anything possible, as they realized fully the dangerous character f the water supplied by their system.

The following letter was received from Health Officer Leighton:

WOODSVILLE, N. H., October 10, 1903.

Dr. I. A. Watson, Secretary.

DEAR SIR:—What is the outlook for the present company's furnishing us with better water for Woodsville? There must be something done about it before long, or our village will be the loser. There are people who would locate here if we had a good water supply who will not come here to live on account of the water. If the company cannot be made to furnish better water soon, they ought to be made to sell their plant at a reasonable figure to some one who will. Please let me know what progress you have made in the matter.

Yours respectfully,
(Signed) A. H. LEIGHTON,
Health Officer.

The foregoing communication was replied to as follows:

CONCORD, N. H., October 30, 1903.

A. H. Leighton, Health Officer, Woodsville, N. H.

DEAR SIR:—Your favor of October 10 was received in due season, but I have not been able to answer it until within a few days.

The subject of a better water supply for Woodsville has been considered by the State Board of Health for some time, and has been brought up at every meeting during the past year.

Within a few days past a communication was sent to the Woodsville Aqueduct Company, which will be printed by them and sent to all their patrons. I need not give the substance of it at this time, as you will see a copy of it very soon.

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I will say that we felt obliged, after a long consideration of the matter, to take a conservative course at the present time, hoping that in the near future the company, itself, or some other parties interested in furnishing a better water supply for Woodsville, will take hold of the matter.

The notice referred to will warn the takers of the danger of the water and prohibit its use for drinking and culinary purposes. To prohibit its use for domestic purposes, other than those named would, we believe, work a public hardship without hastening the action of the company in the matter of obtaining water from some other source than Ammonoosuc River.

Your suggestion, that if the company cannot furnish better water they should be made to sell their plant to some one that will, would, perhaps, be a good one if it could be enforced; but there is no authority whatever that could compel them to take such a course.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

At a meeting of the State Board of Health, held October 20, 1903, the matter was again under consideration, and the action of the board was transmitted to Mr. George E. Cummings, president of the Woodsville Aqueduct Company, as follows:

CONCORD, N. H., October 27, 1903.

Mr. George E. Cummings, President Woodsville Aqueduct Company, Woodsville, N. H.

DEAR SIR:—Inclosed herewith is an official communication to your company, giving the action of the State Board of Health at its last meeting. It is understood by the board that you will publish this communication and transmit a copy of it to each patron of your system.

Please inform me if you will comply with this request.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

CONCORD, N. H., October 27, 1903.

Woodsville Aqueduct Company, Woodsville, N. H.

GENTLEMEN:—At a meeting of the State Board of Health, held at the state house, Concord, N. H., Tuesday, October 20, 1903, the following statement, with recommendations, was adopted:

The State Board of Health has for a long time had under consideration the quality of the water supply of the village of Woodsville, having more than once reported officially, and at various other times pointed out to the public the dangerous character of the water of Ammonoosuc River.

Among the considerations which deter the board at the present time from fully enforcing the authority conferred upon it under the provisions of chapter 38, Laws of 1903, may be stated the following:

1. It is represented by the Woodsville Aqueduct Company that if they were enjoined from taking water from Ammonoosuc River for domestic use, the company would be wholly unable at present to obtain water from any other

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source, and that such prohibition would be greatly to the inconvenience and detriment of the numerous patrons using the said water for other than household purposes.

2. Public notice has been given the water takers of the said Woodsville Aqueduct Company by the company, itself, by the local health officer and by the State Board of Health in published reports that the water is unfit for drinking purposes, so that the families now supplied from this source have, or should have, a thorough knowledge of the character of this supply.

3. It is reported that provisions have already been made by a large part of the community for obtaining water from other sources for drinking and culinary purposes.

In view of all these facts, and pending a further consideration of the matter of obtaining a satisfactory water supply for the said village of Woodsville, and in lieu of prohibiting wholly the use of the present supply, it is

ORDERED: That the Woodsville Aqueduct Company be requested to notify all the patrons of their system that the water supplied by the said company from Ammonoosuc River is unfit for culinary and drinking purposes, and at times exceedingly dangerous to life; that its use for said purposes is forbidden.

Per order,
(Signed) IRVING A. WATSON,
Secretary.

Under date of October 30, 1903, the superintendent of the company caused to be printed and transmitted to each patron of the system the foregoing letter.

TYPHOID FEVER AT WOODSVILLE.

Outbreaks of typhoid fever have occurred in Woodsville from time to time during the past few years, due, it is believed, to an infected water supply. The cases which occurred in March and April, 1899,[1] were doubtless due to infection received through the public water supply, presumably from a case of the disease at Littleton.

As has been stated before, immediately following the receipt of the report of the cases of typhoid fever at Littleton, in January, 1903, the people of Woodsville were warned that their water supply was in great danger, and they were advised not to drink the water until after it had been boiled. Notwithstanding this warning, there were reported to the State Board of Health from Woodsville 48 cases of typhoid fever, undoubtedly due to water pollution from the Littleton cases. Following is a tabulation of typhoid fever reports received from the health officer of Woodsville from December, 1902, to July 16, 1904:

[1] See Vol. 16, Report State Board of Health, page 21.

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TYPHOID FEVER AT WOODSVILLE—WEEKLY RETURNS TO STATE BOARD OF HEALTH.

Date.	No. sick at last report.	Taken sick.	Recovered.	Died.	No. sick at close of week.	No. of infected houses.
1902.						
December 6		1			1	1
December 20	1	1	1		1	1
December 27	1				1	1
1903.						
January 3	1				1	
January 10	1				1	1
January 17	1				1	1
January 24	1	7			8	8
January 31	8	7		1	14	14
February 7	14	8	1	1	20	19
February 14	20	2	2		20	19
February 21	20	4	4	1	19	
February 28	19	1	2	1	17	17
March 7	17				14	14
March 14	14	4	1		17	17
March 21	17	4	2		19	19
March 28	19	6	4		21	18
April 4	21	3	3		21	18
April 11	21	2	4	1	18	16
April 18	18		7		11	11
April 25	11		3		8	8
*						
1904.						
January 16		1			1	1
January 23	1	1			2	2
January 30	2				2	2
March 19		5			5	5
March 26	5	2			7	6
April 2	7				7	6
June 4	1	1			2	2
June 11	2		1		1	1
June 18	1	1			2	2
July 16	1		1			

* No cases in May, June, July, August, September, October. One case in November reported recovered December 12.

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It will be remembered that in all probability Ammonoosuc River received typhoid-infected sewage at Littleton late in December, 1902, or early in January, 1903, and it will be noticed that seven cases of typhoid fever appeared in Woodsville during the week ending January 24, 1903, and that subsequent cases occurred, presumably from the same source, up to the week ending April 11, 1903.

A few slight discrepancies will be noticed in the table, but they do not alter in the least the general deductions.

Under date of September 21, 1904, for the purpose of obtaining the latest facts for this report, a communication was addressed to Health Officer Leighton at Woodsville asking if any cases of typhoid fever had recently occurred in that place, inasmuch as no reports of the kind had been received by the State Board of Health.

The following was his reply:

WOODSVILLE, N. H., September 24, 1904.

Dr. Irving A. Watson, Secretary.

DEAR SIR:—Yours of the 21st at hand, and in reply I am glad to say that we have not a case of typhoid fever, or any of the other contagious diseases reported, in Woodsville (I enclose a copy of the last report I made, which was July 16), since my last report.

I am expecting that very probably we will have cases reported before long, as the heavy rains we are getting will raise the river, after which we have almost invariably, as you know, had a number of cases here.

The people here are using more spring water every year, and as little of the river water as possible, which I think accounts for the few cases of typhoid fever we have had so far this year.

Yours respectfully,
(Signed) A. H. LEIGHTON,
Health Officer.

The situation at Woodsville, with respect to the water supply, may be summarized as follows:

1. The State Board of Health has repeatedly given warning to the citizens of that village, for several years past, that the water supplied by the Woodsville Aqueduct Co., is a constant menace to public health.

2. The fact that water from Ammonoosuc River is dangerous to use for domestic purposes has been kept before the citizens of Woodsville by the local board of health.

3. The water takers have been notified by the company, itself, on more than one occasion, in printed circulars and communications, that their supply was unfit for drinking purposes.

4. The problem of how to obtain a new supply for domestic uses has not been solved.

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5. Water of good quality is being brought into the village and sold to families for drinking purposes.

6. All the facts have been carefully considered by the State Board of Health, and up to the present time it has not seemed to be justifiable to prohibit the company from furnishing water for domestic uses; but such action must necessarily follow if the warnings and notices that have been issued do not reasonably protect public health.

7. Chapter 38 of the Laws of the State of New Hampshire, passed at the January session, 1903, confers upon the State Board of Health authority to prohibit any person or corporation from furnishing water for domestic uses that is so badly polluted as to endanger public health, and it is by virtue of the authority of this act that the board may feel compelled to act at any time. It is imperative that a new water supply for domestic uses be provided for at the earliest possible date.

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REGULATIONS FOR THE PROTECTION OF THE WATER SUPPLIES OF SALEM, TILTON AND NORTHFIELD.

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PROTECTION OF THE WATER SUPPLY OF SALEM (CANOBIE LAKE).

Under date given below the following petition was received by the State Board of Health:

SALEM, N. H., July 20, 1903.

To the Honorable Board of Health of New Hampshire.

GENTLEMEN:—As complaints have come to us that the waters of Canobie Lake are being contaminated, or that filth is allowed to run into the lake, and that people are bathing in the water, and as the people of the town are using the water for domestic purposes, through the pipes of the Salem Water Works Company, we would respectfully ask your board to come and make such rules and regulations as you deem necessary for the protection of the water and the people who are using same at your earliest convenience.

Respectfully yours,

(Signed) F. P. WOODBURY,
E. A. WADE,
T. M. RUSS,
Water Board, Salem Water Works Company.

The foregoing petition was presented to the State Board of Health at a meeting held August 25, 1903, and upon the same the secretary made the following report:

In order to be able to act more intelligently upon a petition of the Salem Water Works Company for the protection of the water supply, the secretary visited the locality on Tuesday, August 4, and thoroughly investigated conditions.

As is well known, several electric lines from various points of the compass, and connecting directly with numerous large cities, bring thousands of people to Canobie Lake Park each season, the total for some single days aggregating 14,000 persons.

The Park Company has expended a large sum of money in beautifying the locality, in establishing a system of sewage disposal, water works, etc., all of which they have done with a view to protecting the place against any possible contamination. The Park Company pumps water directly from the lake to a distributing tower, so that it is available for drinking purposes by the many who resort to the park.

The Salem Water Works Company in 1902 put in a system to supply a portion of the inhabitants of the town of Salem, supplying approximately 600 persons.

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The quality of the water in the lake is excellent, as shown by several analyses at the State Laboratory of Hygiene.

Upon the shores of Canobie Lake are some 70 cottages, aside from the buildings owned by the Park Company. It is known that in some instances sewage from private cottages is discharged directly into the lake; also that a small number of persons make a practice of bathing in the lake, which is seriously objected to by some of the water takers. The area of this lake appears, from a casual observation, to be somewhat less than that of Penacook Lake, and it is given in Hitchcock's Geology as seven tenths of a square mile. The lake (formerly known as Policy Pond) lies in the towns of Salem and Windham. Nearly all of the shore that is now inhabited is in the town of Salem. The location is a pretty one, has become popular on account of the park and transportation facilities, and is likely within a few years to have a great many cottages built along its shores.

When all phases of the situation are considered, it would seem that the petition of the Water Board is a reasonable one, and that regulations to protect the water of this lake against contamination should be put in force in the interests of the public.

After further discussion of the question, the following preamble and regulations were adopted:

THE STATE OF NEW HAMPSHIRE.

Whereas, A legal petition having been presented to the State Board of Health asking for the establishment of regulations to protect the purity of the water of Canobie Lake under the provisions of Chapter 57, Laws of 1899, entitled "An Act for the better protection of public water supplies," the following regulations are promulgated:

REGULATIONS OF THE STATE BOARD OF HEALTH FOR THE PROTECTION OF THE PURITY OF THE WATER OF CANOBIE LAKE, IN THE TOWNS OF SALEM AND WINDHAM.

1. No privy, pig-pen, stable, or other building or structure in which horses, cattle, swine, or other animals or fowls are kept shall be built, continued, or maintained within 75 feet of Canobie Lake (meaning high water mark), or within 75 feet of any bay, cove, or inlet thereto, except in such cases as the local board of health may permit, upon the approval of the State Board of Health, and under such regulations as they may require.

2. No sinkwater, urine, or water that has been used for washing or cleansing either materials, person, or food, shall be allowed to run into said lake, or into any bay, cove, or inlet thereof, or into any excavation or cesspool in the ground, or on the surface of any ground, within 75 feet of said lake (meaning high water mark), or of any bay, cove, or inlet, except by consent, and under such regulations and conditions as may be given by the local board of health upon approval of the State Board of Health.

3. No dead animal, or fish, or parts thereof, or food, or any article perishable or decayable, and no dung, either human or animal, kitchen waste, swill, or garbage shall be thrown into or deposited in said lake, or left or permitted to remain within 75 feet thereof (meaning high water mark), or into any bay, cove, or inlet of said lake, or within 75 feet of such bay, cove, or inlet.

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4. No person shall bathe or swim in said lake.

5. No boat, either for public or private use, nor house-boat or other construction for use to float, steam, or sail upon said lake, shall have, keep, or maintain a ship-closet, urinal, or other construction of easement which shall permit excrement or other offal to fall or empty into said lake.

6. No matter, waste, or materials such as are described in sections 2 and 3 shall be thrown, deposited, or allowed to remain upon the ice of the waters of said lake, or upon that of any bay, cove, or inlet thereof.

7. It is the duty of the local board of health to enforce the above regulations, and any person violating any regulation established by the State Board of Health is liable to a fine of twenty dollars ($20) for each offence.

8. All of the foregoing regulations will take effect and be in force on and after October 15, 1903. Any deviation from the above rules must be by recommendation of the local board of health, and with the written consent of the State Board of Health.

REQUESTS TO MODIFY FOREGOING RULES.

An attempt was made to secure such modifications of the foregoing rules and regulations for the protection of the water of Canobie Lake as would permit bathing in the lake by the people residing upon its shores. The following correspondence, with the action of the board thereon, is given for the purpose of showing how the matter was regarded by the petitioners, as well as the conclusions arrived at by the board:

Ivar L. Sjöström,
M. Am. Soc. C. E.
Consulting Engineer.

LAWRENCE, MASS., August 11, 1904.

Dr. Watson, State Board of Health, Concord, N. H.

DEAR SIR:—The writer represents the Camp Ludwig Association, incorporated under the laws of New Hampshire, who own property in Salem, N. H., on the shores of Canobie Lake, and have spent several thousand dollars, largely for the purpose of availing themselves of the bathing facilities.

We have noted your order forbidding bathing in this lake, and have hitherto refrained from expressing any opinion in the matter, but have been in the meantime carefully considering all phases of the case.

While we heartily approve your attitude in putting restrictions on the contamination of the water, yet we feel that considering the size of this body of water, and the comparatively few people who are using it for drinking purposes, that the amount of bathing done in this lake cannot be injurious to the health of the takers of this water, and the benefits arising from people taking their ablutions in this manner is certainly great.

Under the circumstances, would it be too much to request your board to reconsider your action, and grant such parties as make application the right to use the water in a limited way for bathing purposes?

We feel that you do not intend to put any unnecessary hardships on people who have invested their money in lakeshore property a number of years before the taking of water for drinking purposes was contemplated.

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We were never given an opportunity to attend any hearing and state our views, and the writer would esteem it a personal favor to have an interview with your board, with the object of seeing if we cannot be afforded some relief.

Awaiting your kind reply, I remain,

Yours very truly,

(Signed) I. L. SJÖSTRÖM.

CONCORD, N. H., August 19, 1904.

Ivar L. Sjöström, C. E., Lawrence, Mass.

DEAR SIR:—In reply to your favor of August 11 I would say that your communication will be laid before the State Board of Health at its next regular meeting. I think I can assure you, however, that the board will not accede to your proposition to modify the rules and regulations established for the protection of the purity of the waters of Canobie Lake to the extent of allowing bathing in that body of water.

Regulations that prohibit bathing have been established to cover several bodies of water in this state, some of which are considerably larger than Canobie Lake, and I am certain of the attitude of the board with respect to this subject.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

LAWRENCE, MASS., August 20, 1904.

Mr. Irving A. Watson, Concord, N. H.

DEAR SIR:—I acknowledge receipt of your esteemed favor of the 19th and thank you for the trouble you have taken in writing me. I do not, myself, think that it would be a wise idea to allow the thousands of excursionists to indulge in promiscuous bathing, but it does seem to me that householders who have enjoyed the privilege hitherto might, without injury to anyone, be allowed to continue the same, especially in view of the fact that these cottages are all remote from the source of supply, and the people who live in them are cleanly persons. I trust you will place our views before the board at its next meeting, and thank you in advance for the trouble you have taken.

Yours very truly,

(Signed) I. L. SJÖSTRÖM.

BOSTON, MASS., August 29, 1904.

President N. H. Board of Health, Concord, N. H.

SIR:—I take the liberty of addressing you to get your advice. I own a cottage at Canobie Lake, Salem, N. H., and when I made this investment, several years ago, we had the privilege of bathing in the said lake, and it is hardly necessary to say we derived much benefit from it, and certainly enjoyed it.

Last year, without ever informing us of their intention or giving any of us non-resident taxpayers the slightest chance to be present at the town meeting when this matter was voted upon, the local board of health pasted notices on our houses that bathing would be prohibited after the 15th of October. You can well imagine that this is very hard on the campers around the lake, not alone the pleasure we derived from bathing, but also that it greatly deteriorates the value of the property.

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Why this should have been done we cannot understand, as only a very few in Salem use the water in their barns and houses, and certainly not for drinking purposes, and it seems to me that as the town of Salem received quite a good revenue in taxes from non-residents, when formerly they hardly knew that such a lake ever existed so near their town, they should at least give us the chance of stating our side of the case before voting to take bathing off.

I, therefore, most earnestly petition you if possible to restore to us the bathing privilege in said lake, and if this cannot be done, to at least set aside a certain part of the lake for bathing, far enough removed from the pumping station, which certainly could be improved by filtering beds so that no impurities would enter the water pipes.

I hope I have not annoyed you and also to receive a favorable reply.

Thanking you in advance I remain,

Yours very respectfully,

(Signed) G. G. LEDDER.

LAWRENCE, MASS., September 6, 1904.

Dr. Irving A. Watson, Secretary State Board of Health, Concord, N. H.

DEAR SIR:—I write you to inquire if something could be done to return to the cottagers the privilege of bathing at Canobie Lake in the town of Salem, also to solicit your aid in having the restriction removed if possible. It seems to me it is rather unjust to the non-resident taxpayers to have this restriction put on without giving them notice that a hearing would be given and a chance for them to remonstrate.

This water is taken (as far as I can learn) by a private company under a charter given them to secure fire protection for the village. It seems to me that reasonable men would not give them the right to place restrictions that interfere with the rights of property owners and decrease the value of property, if they thoroughly understood the situation, and I think as a private company they should be compelled to put in filtering apparatus, if the water is to be used for drinking purposes. If the town had put this through instead of a private corporation, I think the standing might be different, but I think it is safe to say that not more than a dozen or fifteen people use this water for drinking purposes, and as a taxpayer I think it unjust to allow them to restrict privileges under this condition.

I might add that so far as my knowledge of the campers exist (and I have been at the lake with my family for several years), the Salem people who own, or have owned property there, have been the least careful of preserving the purity of the lake and the respectability of the neighborhood.

I would be pleased to have the board investigate this matter, and if they would take the trouble to come to the lake I will entertain them while there at my camp and at my expense.

I can assure you that the people who own their own property at the lake, and do not rent same, are perfectly in accord with a desire for a thorough investigation, and of the uselessness in prohibiting bathing.

Yours truly,

(Signed) T. HOLGATE,
Asst. Supt. Pacific Mills.

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The opinion expressed in the last letter given above, that only a few persons use this water for drinking purposes led the secretary to make inquiries of the local board of health for information upon this point, and the following was received:

SALEM DEPOT, N. H., Sept. 16, 1904.

Irving A. Watson, M. D.

DEAR SIR:—Yours of the 14th at hand. Yesterday I saw Mr. Williams, superntendent at Canobie Lake Park, relative to your inquiry regarding the consumption of water by thousands of persons at Canobie Lake.

He informed me that all of the water used there is taken from the lake. There is a well located where the pump is, but it is so near the lake that it practically is the same water.

I saw Mr. Russ, president of the Water Works Company, last night. He estimates the number of persons using the water as five persons to a family. There are about 85 takers of water, and he thinks 400 persons or over use the water one way or another. . . .

Respectfully,

(Signed) JAMES AYER,
Secretary Board of Health.

At a special meeting of the State Board of Health, held September 21, 1904, the foregoing communications were considered, together with other matters bearing upon the question of this water supply, and the board voted "That the petitions be respectfully dismissed." The petitioners were informed of this action as follows:

THE STATE OF NEW HAMPSHIRE.

STATE BOARD OF HEALTH.

SECRETARY'S OFFICE, STATE HOUSE.

PETITIONS TO ALLOW BATHING IN CANOBIE LAKE.

This question was fully discussed before the rules and regulations referred to were adopted and promulgated, and a subsequent examination of the situation does not present to the board any good reason why the regulations should be changed. On the other hand, the board believes that the regulation is a reasonable one, and that it should be sustained and enforced.

Some of the statements made by the petitioners were evidently based upon incorrect information concerning the situation. The facts in the case are substantially as follows:

1. The Salem Water Works Company furnish drinking-water to approximately 400 persons.

2. The drinking-water supplied to the many thousand visitors who go to Canobie Lake each summer is pumped either directly from the lake or from a single shore well, which furnished practically the same water.

3. It is conceded by all authorities that bathing in a public water supply, aside from esthetic considerations, presents an opportunity to infect the water, and particularly so should a bather be convalescing from typhoid fever.

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4. The State Board of Health could not make a reasonable or valid regulation giving certain persons the privilege of bathing in this lake, and restricting others.

5. After considering all these points the State Board of Health voted, "That the petitions be respectfully dismissed."

(Signed) IRVING A. WATSON,
Secretary.

Concord, N. H., September 21, 1904.

PROTECTION OF THE TILTON AND NORTHFIELD WATER SUPPLY.

The following correspondence shows what conditions existed in connection with the water supply of the towns of Tilton and Northfield, and that led to the action taken by the State Board of Health in the matter:

TILTON, N. H., March 15, 1904.

I. A. Watson, M. D., Concord, N. H.

DEAR DOCTOR:—We find that parties have been teaming across the pond where we get our water supply all winter, and we have insisted that they clean up the ice. Are we exceeding our authority any? As we understand the matter, under the law we could be perfectly justified in either compelling the parties to clean up, or doing so ourselves, and collect the bill of them. If I am incorrect, please advise.

Also, supposing one of the abutting owners of the pond claims a right to team across there in the winter, can we not, as the board of health, prevent his doing so?

Very truly yours,
(Signed) ARTHUR T. CASS,
Member Board of Health.

The following letter was sent in reply:

CONCORD, N. H., March 16, 1904.

Arthur T. Cass, Member Board of Health, Tilton, N. H.

DEAR SIR:—Your favor of March 15 received. In reply I would say that you have a right to protect your ice and water supplies from contamination, to the extent of compelling parties who team across the pond to clean the ice. I would call your attention to Section 1, Chapter 76, Pamphlet Laws, 1895, which prohibits any person from knowingly defiling water or ice that is taken for public use.

I am not certain that you could prevent a riparian owner from crossing the ice with a team; but you certainly could compel him to take such measures as would prevent ice contamination.

It is possible that you have a right to prohibit teaming on this body of water. On this question I would advise you to consult good legal authority.

Very truly yours,
(Signed) IRVING A. WATSON,
Secretary.

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Under date given below, Judge W. B. Fellows, of Tilton, transmitted a petition signed by a majority of the members of the boards of health of the towns of Tilton and Northfield, with a letter as follows:

TILTON, N. H., March 25, 1904.

Dr. Irving A. Watson, Concord, N. H.

DEAR SIR:—I enclose a petition to the State Board of Health signed by and in behalf of the boards of health of the towns of Tilton and Northfield under the provisions of Chapter 57, Laws of 1899.

It is hoped the State Board of Health will come here at once so as to view the situation while the ice is on the pond.

The pond is public water, and the water company seem to be powerless to prevent teaming on it. Furthermore, the exception as to handling lumber, in Section 1, Chapter 76, Laws of 1895, seems to relieve lumbermen from the other provisions of that section, and it seems to be a question as to how far Sections 13 and 14, Chapter 108, Public Statutes, are modified by Chapter 76 above mentioned.

If the local boards of health are powerless and the water company is powerless, there seems to be but one remedy for the public, and that is under Chapter 57, Laws of 1899, and it looks as if that chapter was enacted to cover this very case.

There is a highway on the pond now which will be obliterated by warm weather within a few days, hence the need of immediate attention that you may see all the conditions.

Yours truly,
(Signed) W. B. FELLOWS.

PETITION.

[See New Hampshire Laws 1899, Chapter 57.]

To the New Hampshire State Board of Health:

The undersigned boards of health of the towns of Tilton and Northfield in the State of New Hampshire respectfully represent that they have reason to believe that a public water and ice supply, viz., Chestnut Pond, so called, in said Northfield, the source of water supply for public and domestic uses in said towns, is in danger of contamination by teaming across said pond on the ice, and that the local regulations are not sufficient and effective to prevent contamination and pollution. They therefore request you to investigate the case and to establish such regulations as you may deem necessary for the protection of the said supply against any pollution that will endanger the public health.

(Signed) JOHN E. SENTER,
GEO. S. MORRISON,
Board of Health of Northfield, N. H.
ARTHUR T. CASS,
CHAS. A. TOWNS,
Board of Health of Tilton, N. H.

March 25, 1904.

Following the receipt of the above petition the secretary of the board visited Chestnut Pond in the town of Northfield and examined the condi-

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tions complained of. It was found that certain parties had been teaming the entire length of the pond during the greater part of the winter, hauling lumber to a portable sawmill a short distance below the pond, and as no attempt had been made to prevent the pollution of the ice by the animals used in teaming, the road had gotten into such a condition as to create an unquestionable nuisance.

The parties responsible for this condition were, at the time of the examination, scraping and carting off large quantities of this material, although it was not possible to remove all of it.

The facts were presented to the State Board of Health when the petition was under consideration. The president of the water board, together with other interested parties, personally appeared at the office of the board and urged action in the matter.

At a meeting of the board, held April 27, 1904, the following was adopted:

THE STATE OF NEW HAMPSHIRE.

WHEREAS, A legal petition having been presented to the State Board of Health, asking for the establishment of regulations to protect the purity of the water of Chestnut Pond, from which the public water supply of the villages of Tilton and Northfield is taken; and the matter having been carefully considered with respect to present and possible future conditions, the following regulations are promulgated under authority given the said State Board of Health in Chapter 57, Laws of 1899:

REGULATIONS OF THE STATE BOARD OF HEALTH FOR THE PROTECTION OF THE PURITY OF THE WATER OF CHESTNUT POND IN THE TOWN OF NORTHFIELD.

1. No privy, pig-pen, stable, or other building or structure in which horses, cattle, swine, or other animals or fowls are kept, shall be built, or maintained within 75 feet of Chestnut Pond (meaning high water mark), or within 75 feet of any inlet thereto, except in such cases as the local board of health may permit, upon the approval of the State Board of Health.

2. No sinkwater, urine, or water that has been used for washing or cleansing either materials, person, or food, shall be allowed to run into said pond, or into any inlet thereof, or into any excavation or cesspool in the ground, or on the surface of any ground within 75 feet of said pond (meaning high water mark), or of any inlet, except by consent, and under such regulations and conditions as may be given by the local board of health, upon approval of the State Board of Health.

3. No dead animal, or fish, or parts thereof, or food, or any article perishable or decayable, and no dung, either human or animal, kitchen waste, swill, or garbage shall be thrown into or deposited in said pond, or left or permitted to remain within 75 feet thereof (meaning high water mark), or into any inlet of said pond, or within 75 feet of such inlet.

4. No person shall bathe or swim in said pond.

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5. No matter, waste, or materials such as are described in Sections 2 and 3, shall be thrown, deposited, or allowed to remain upon the ice of the waters of said pond, or upon that of any inlet thereof.

6. No cattle, horses, or other animal used either for teaming, riding, or speeding, shall be driven, ridden, or speeded upon the ice of said pond, except by permission of, and under such regulations as may be given by the local board of health, upon approval of the State Board of Health.

7. It is the duty of the local board of health to enforce these regulations, and for the violation of any regulation established by the State Board of Health adequate punishment is provided by law.

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SPECIAL REPORTS, INSPECTIONS, INQUIRIES, ETC., CONCERNING WATER SUPPLIES.

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SPECIAL REPORTS OF INSPECTIONS OF WATER SUPPLIES.

It is the policy of the State Board of Health to make inspections of water supplies where the surroundings are such that there is a possibility of contamination or where local conditions demand thorough consideration. In several instances local boards of health have requested the State Board to visit their water supplies for the purpose of advising the change of sewers so located as to afford a possible source of contamination and for suggesting practicable methods for preventing further pollution.

Correspondence and reports of investigations are given below as an illustration of this branch of the work of the State Laboratory and as guides to towns where similar conditions may exist.

DERRY, N. H., October 18, 1902.

Dr. Irving A. Watson, Concord.

DEAR SIR:—A large shoe factory employing I should judge some 600 men is constructing a cesspool close to the bank of a brook that flows close by the wells of the Derry Water Works Company, about 3,400 feet distant. It seems to me that such a cesspool is quite likely in a short time to become a serious menace to the purity of our water supply, and even if it is not it will greatly disturb the peace of mind of the people obliged to use the water. The factory is about 400 feet from the brook and the ground slopes to the brook quite rapidly.

Please write me your opinion in regard to this matter in such form that I can show it to the proprietors of the factory.

Careful tests show that our pumps draw water from the brook through the wells.

Yours, etc.,
C. S. CAMPBELL.

STATE BOARD OF HEALTH.

CONCORD, N. H., October 28, 1902.

Prof. C. S. Campbell, Derry, N. H.

DEAR SIR:—The State Board of Health received from you, on October 19, 1902, a communication requesting the advice of the Board relative to the construction of a cesspool by the Perkins & Hardy Co., close to the bank of a brook which flows by the wells of the Derry Water Works Co., some 3,400 feet distant, and inquiring if the construction of the cesspool would impair the quality of the water furnished by said company.

The Board has caused the locality to be examined by its chemist, and has considered the plans for the disposal of its sewage by the Perkins & Hardy Co.

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It appears that the supply of the Derry Water Works Co. is derived from a number of driven wells some 40 feet in depth, located in a meadow bordered by a brook which drains the larger part of the village of West Derry. A private sewerage system disposes of much of the sewage of the village, but at present cannot be reached by the Perkins & Hardy Co. It has, therefore, been proposed by the company to build a cesspool and filter chamber on the bank of the brook which will receive the waste and drop water from their boilers, water taps, etc., and to build a system of cesspools or septic tank some 400 feet from the brook which will receive the sewage from the closets of the shop. The sewage will be treated in the septic tank and the filtered effluent passed into the cesspool which is located near the brook, and from there pass into the brook after undergoing a second filtration.

It is also proposed to change the course of the brook opposite the shops so that it will flow on the opposite side of the meadow, some 400 feet from its present channel.

When these plans for the disposal of waste, drip, tap water and sewage from the closets of the factory are carried out and after the course of the brook is changed, there will be no pollution of the brook from these sources.

It is possible that the large number of cesspools located along the ridge that drains into the brook will eventually pollute the water o a considerable extent, but at present they do not appear to have done so. The main pipes of the sewerage system discharge into the brook some 10 rods beyond and below the wells of the water company and the sewage is at once carried away by the rapid current.

A chemical analysis of water from the wells of the Derry Water Co. shows it to be of excellent quality. Whether it will deteriorate when drawn continuously and in increasing amounts cannot be predicted definitely. The ground water underlying the meadow flows away quite rapidly in the direction of the brook and it is therefore probable that the wells derive their main supply from springs and not from the brook.

The Board recommends that Perkins & Hardy be allowed to construct and operate cesspools and filter chambers according to the plans herein discussed and suggests that the present sewerage system be enlarged until it drains all parts of the watershed of the brook which passes the wells of the Derry Water Company.

Very respectfully,
IRVING A. WATSON,
Secretary.

NOTE.—Perkins & Hardy at once installed a system of cesspools and filter chambers after plans suggested to them by the State Board of Health. Since then there has been no further fear of contamination of the water supply and repeated analyses of the water have shown that its quality is not at present affected by seepage from the brook.

In the spring of 1903 the board of health of Pittsfield applied for advice relative to preventing the pollution of the watershed of the Pittsfield Aqueduct Company. It appeared that the owners of land by the side of

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the stream supplying the reservoir of the company had spread "night soil" and barnyard manure on slopes draining directly into the stream, thus exposing the water supply to a serious pollution. The board of health, after requesting the removal of the nuisance, without avail, applied to the State Board for advice and in response to their request an examination was made of the reservoir, tributary streams and watershed, and a report rendered as follows:

STATE LABORATORY OF HYGIENE.

CONCORD, N. H., April 29, 1903.

P. S. Elliott, Chairman Board of Health, Pittsfield, N. H.

DEAR SIR:—In response to your request of the State Board of Health for advice as to the possibility of pollution of the water supply of the Pittsfield Aqueduct Co. by surface drainage and leachings from fertilizers applied on the watershed of the tributaries supplying the reservoir of said company, I have personally examined the reservoir, tributary streams and watershed.

Analyses No. 1112 and No. 1117, made of water taken from the reservoir at the intake, both before and after heavy rains, show the water to be of excellent quality; but containing considerable sediment and dissolved organic matter. It is free from sewage and is an acceptable supply.

From an examination of the reservoir, the brook tributary to it and its adjacent watershed, I found that the brook runs for some distance through a field owned and cultivated by Lewis B. Adams. This field is located on a hillside which slopes sharply in two directions, thus draining into a "run" communicating with the brook supplying the reservoir, and on a small "meadow" which is bordered on one side by the "run" and on the other by the brook itself.

It appears that the said Adams has been in the habit of applying to this field so-called "night soil" taken from vaults in the village of Pittsfield, and at the present time ground on the upper slope of the hillside about two hundred (200) feet from the run is covered with this "night soil." It is evident that heavy rains will wash portions of this "night soil" down the hillside into the "run," through which it will be carried to the brook and thence to the reservoir, thus exposing users of the water to danger. Portions of the "meadow" are also heavily covered with the stable manure which will be readily washed into the "run" and brook, increasing the color and organic content of the water and to a certain extent rendering it unfit for use.

These conditions are detrimental to the health of users of the water and should be remedied at once.

No human or animal excrement should be placed on any portion of the field of L. B. Adams which drains toward the "run" or brook. The only fertilizers allowable are the mineral fertilizers or raw chemicals unmixed with bone or other animal waste. These raw chemicals may be used in moderation without impairing the quality of the water.

In view of possible contamination of the water supply by surface wash and fertilizers I suggest that the Pittsfield Aqueduct Co. purchase this field and allow it to become wooded, thus effectually guarding against deleterious surface wash of any kind.

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I am not prepared to suggest legal measures which would be of service in prohibiting Mr. Adams from dressing his land as he may desire. Section 13, chapter 108 of the Public Statutes is explicit on this matter but prosecutions brought to test the strength of the law would be expensive and long drawn out. If the land cannot be bought at a reasonable price an injunction restraining Mr. Adams from placing dressing from vaults or barn on such portions as slope towards the "run" and brook can undoubtedly be obtained from the courts.

We have no precedent for such action but feel sure that when the court understood the situation it would not hesitate to grant a permanent injunction.

I also suggest that the water company scrape the bottom of the reservoir free from silt and mud; build bank walls around the shore suitable for preventing surface wash from entering the reservoir; erect such fences as will keep animals out of the enclosure; and keep, at all times, the banks free from vegetable growths. Such measures will improve the color of the water, decrease its turbidity and render it more free from dissolved organic matter.

Trusting that this report will be serviceable to you and assuring you of our desire to aid you in preserving the purity of your water supply, I am,

Yours very respectfully,

H. E. BARNARD,
Chemist.

THE LEBANON WATER SUPPLY.

In 1897 a supply was installed by the fire precinct, the source being a canal leading from the Mascoma River, which was also utilized as a source of power for pumping the water to the reservoir.

After several years of satisfactory service it became apparent that the Mascoma River was being seriously polluted by sewage from the village of Enfield and by factory waste. A series of driven wells was, therefore, sunk in a triangular piece of ground lying between the river and the canal, the idea being that they would be supplied by infiltration of water from the canal, and that the water so obtained would be thoroughly purified from sewage in its passage through the ground. It was found, however, that the supply of water from these sources was insufficient and an additional large gallery well, 63x30x15 feet, was dug and 900 feet of loosely-jointed drain pipe laid in such a way that all their discharge was collected at the well.

The supply of water being still insufficient, two long trenches about six feet deep and 12 feet wide were excavated between the drain pipe to receive water directly from the canal. At the most there is less than 20 feet of earth between these trenches and the drain pipes.

The condition of the water has been good up to August of this year, when a sample of water, collected from a tap of the supply, showed the presence of the colon bacillus.

Thereupon the following letter was sent to the shipper of the water together with the report of the analysis (see No. 2251, page 49):

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STATE LABORATORY OF HYGIENE.

CONCORD, N. H., August 13, 1904.

C. E. Lewis, Lebanon, N. H.

DEAR SIR:—I have just reported to Mr. R. B. Jacobs of your town the analysis of a sample of water from a tap of the town supply. And that you may understand the situation I am enclosing you a copy of my letter to him. It is evident that if the condition of your water supply is indicated by the results of the analysis of this particular sample that some steps should be taken at once to determine the cause of the unfavorable condition and to remedy it. The presence of the colon bacilli,—the bacillus which is found in fecal matter and no where else,—is a suspicious indication of pollution by sewage, and unless it can be explained away by finding that it is due to contamination by cattle or by surface washings from pastured land, the condition of the supply is certainly bad.

I trust you will at once make a thorough examination of the supply and of the end of the pipe from which Mr. Jacobs drew his sample.

The water from your supply has always been of excellent quality and my analysis about two months ago was entirely satisfactory. If the entire supply is now of the quality shown by this last analysis its condition has been much changed.

Very truly yours,
H. E. BARNARD,
Chemist.

Following the discovery of the colon bacilli in the supply several analyses were made of water from the well, river and reservoir. The well water was free from the colon bacilli, but the other samples contained them. This unusual condition suggested the idea that water was being pumped directly from the river to the reservoir, and as a precautionary measure the chairman of the Board of Water Commissioners was addressed as follows:

STATE BOARD OF HEALTH.

CONCORD, N. H., September 13, 1904.

C. E. Lewis, Chairman Board of Water Commissioners, Lebanon, N. H.

DEAR SIR:—The condition of your water supply, as revealed by chemical and bacteriological examinations at the State Laboratory of Hygiene, is such as to be looked upon with considerable apprehension, to say the least. Several analyses have been made of this water supply from June, 1901, to the present time; but not until analysis No. 2251, made August 12, 1904, when colon bacilli were found, was there anything to render this water suspicious. A previous analysis, made May 19, 1904, showed the water to be in its normal condition. Another analysis, No. 2293, made August 26, 1904, also revealed colon bacilli. This sample was taken from the same source as sample No. 2251; to wit, tap from town supply at the mill of Mr. R. B. Jacobs.

On the same date as the latter an analysis was made of another sample, No. 2294, taken from a tap on Main Street, in which colon bacilli were found. On the 9th of the present month bacteriological examinations of the water were

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made by Dr. Charles Duncan, at the State Laboratory of Hygiene, as follows: No. 2347, from well near river; colon bacilli not found. No. 2348, river water; colon bacilli present. No. 2349, reservoir water; colon bacilli present.

The fact that colon bacilli were not found in the well water does not indicate positively the purity of that water, although they escaped detection in the sample examined.

It would seem that the wells from which the water is pumped, as we understand the situation, must be receiving their supply from a sewage-polluted source, and that the intervening earth does not act as a filter further than to arrest suspended matter, or that the earth is saturated with sewage beyond its power to oxidize—else water is being pumped to your reservoir without being filtered at all.

The fact that colon bacilli and typhoid bacilli will pass through otherwise adequate filter beds or masses of earth, without being destroyed, makes it impossible to purify a water that is sewage-polluted by filtration of this kind. It has been proven repeatedly that wells sunken along a river or pond in this way do not receive a thoroughly filtered water.

It is evident that your reservoir and main are receiving water containing bacteria derived from sewage, although the amount is comparatively small. It is not, however, the purpose of this letter to discuss this phase of the question, but, rather, to inform your board officially, that this water possesses certain elements of danger that should receive your immediate consideration. We would, therefore, suggest that you notify your water takers that all water to be used for drinking should be boiled for the present, or until there is a change in the situation.

While the colon bacillus is not regarded as, in itself, dangerous, it does constitute a warning that such waters are liable to contain the typhoid bacillus also, the latter of which, although it may exist in sufficient numbers to cause a typhoid fever epidemic, has very rarely been isolated in the water itself. Examinations, therefore, are not made for the typhoid bacillus, but when the colon bacillus is present the warning should be heeded.

The advice herewith given is for the purpose of protecting the public health until you can make such changes as will place your supply beyond all danger of typhoid infection.

We feel obliged to transmit a copy of this letter to the Board of Health of Lebanon.

Very truly yours,
IRVING A. WATSON,
Secretary.

Three days after the receipt of this letter the following notice was sent to users of the Precinct water supply:

NOTICE.

Owing to the low state of the water in the lake the condition is such that the Board of Health consider that the water should be boiled before using for drinking purposes until further notice.

C. E. LEWIS,
Superintendent.

September 16, 1904.

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On September 19 a request was received from Dr. Von Tobel, a member of the Board of Health of Lebanon, that a personal examination of the locality from which the public water supply is taken be made by a representative of the State Board of Health. This request was granted and on the 22d the following report was made to Dr. Von Tobel:

STATE BOARD OF HEALTH.

CONCORD, N. H., September 22, 1904.

Dr. F. Von Tobel, Member Board of Health, Lebanon, N. H.

DEAR DOCTOR:—In response to your request by telephone, that a representative of the State Board of Health examine the locality from which your public water supply is taken, I sent, on the following morning, September 20, as you know, Mr. H. E. Barnard, Chemist, State Laboratory of Hygiene, to investigate the subject as far as practicable. Mr. Barnard reported as follows:

It appears that the water, which is pumped into the reservoir, is taken from wells that are filled by infiltration from Mascoma River, and that in dry seasons, when much water is used for sprinkling streets, lawns, etc., this supply is inadequate, making it necessary to pump water directly from the river into the reservoir. Inasmuch as Mascoma River received the sewage of Enfield, with its several factories and numerous dwellings located directly on the river that flows into Mascoma Lake, it is evident that sewage must be present at all times in the water as it reaches the pumping station. To remove this sewage a large well has been sunk in the ground lying between the river proper and the canal that furnishes power at the pumping station.

This well is further supplemented by other wells and a drainage pipe extending the entire length of the ground mentioned above, which are supplied by filtered water from two trenches that run beside and above the drainage pipe. Under ordinary conditions it is probable that the water is purified in passing through the ground between the canal and the wells, and the examinations that we have made of the water sustain this statement. Nevertheless the capability of a soil to purify a water indefinitely depends greatly on the amount of sewage in the water, the nature of the filtering material, the rapidity of the flow of the water, and the distance through which it passes, so that we cannot say how long the water in the wells will remain pure. Frequent chemical and bacteriological analyses will be made of water from the reservoir, and in that way any change of condition will be quickly noted.

You will see that the report is a conservative one, as no other could be expected at this time, for the reason that the data upon which an opinion concerning the character of the water in the well from which the town supply is supposed to be pumped are too meagre at this time for a basis for a conclusive statement, inasmuch as but one analysis of the well water has been made since the colon bacillus was discovered in the sample of water from the reservoir.

It is true that the one analysis of the well water was negative, but that does not conclusively prove that the colon bacillus might not have been present.

As Mr. Barnard suggests, nothing but occasional analyses, chemical and bacteriological, of the water from this well will determine the filtering capacity of the soil. It may, or may not, be sufficient to exclude pathogenic bacteria.

Sterilized containers have already been forwarded for the collection of more samples of water, and frequent examinations will be made to determine whether or not the water from the well is a safe supply for the public.

We now know that the presence of the colon bacillus in the reservoir was due

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to the pumping of unfiltered water directly from the river into the reservoir. Until the question of the character of the water is settled we believe that the precautions which have already been suggested should still be maintained.

Very truly yours,
IRVING A. WATSON,
Secretary.

The theory that the presence of the colon bacillus in the reservoir was due to the fact that water was being pumped directly from the river was substantiated by the inspection of the supply. But as it seemed, at least, possible that the earth banks were not satisfactorily filtering the water a series of bacteriological analyses have been made of water from the storage well. The results of these analyses proves the presence of the colon bacillus in the filtered water and makes it incumbent upon the precinct to devise some satisfactory method of purifying the Mascoma River water or to seek a new source of supply.

SPECIAL INQUIRIES CONCERNING WATER SUPPLIES.

In the course of our analytical work on waters we frequently receive inquiries concerning the meaning of our reports; the proper kind of pipe most suited for conveying certain waters; the possibility of purifying wells that have been condemned because of sewage pollution; the treatment necessary to remove odor, color or turbidity, from foul waters. We believe that information of this character is as valuable as the analyses themselves, and wherever possible we endeavor to give it.

Below are a few self-explanatory letters and answers that will show the nature of the many inquiries, and also give a general idea of the conditions to be met and the methods to be employed in so doing.

LITTLETON, N. H., May 19, 1903.

Mr. Irving A. Watson, Secretary Board of Health, Concord, N. H.

DEAR SIR:—We had some correspondence with you recently concerning spring water which you analyzed. This was water which came from a slope near the river five or six feet from the surface of the ground and it was evidently surface water.

We decided not to use this water and will now make another inquiry. Our factory is situated on the bank of the Ammonoosuc River, and we will ask that, if we should drive a pipe a few feet from the river and run it down 15 or 25 feet below the bed of the river would there be any chance for fever germs or impure water to reach our pipe. A member of our local board of health says there would be no such danger as there would be below the bed of the river. If this seems favorable to you, please advise how deep you would drive the pipe to secure pure water.

Your prompt attention will be considered a great favor by

Yours very truly,
THE LITTLETON SHOE COMPANY.

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STATE LABORATORY OF HYGIENE.

CONCORD, N. H., May 25, 1903.

The Littleton Shoe Co., Littleton, N. H.

DEAR SIRS:—Your communication of the 19th inst. concerning a new source for a water supply for your shops is at hand. In reply I would say that your proposed action in sinking a pipe below the bed of the river does not meet with our approval inasmuch as it has been proven time and time again that it is impossible to remove entirely typhoid germs from water by ordinary sand filtration. While you would undoubtedly secure a very clear and palatable supply, the danger of contamination from the water of the river would certainly put the water on the doubtful list as regards permanent purity.

The stratum of sand above the level on which you propose to draw for water is saturated with the river water and not exposed to the bacterial action which is necessary to make successful the purification of water by sand filtration, and, while it is probable that the Ammonoosuc River is usually free from the germs of typhoid, it is possible that in case the river was infected some of the germs would filter through the sand and reach your supply. In view of this possibility, however remote it may be, I suggest that you take other measures looking toward a supply of absolute purity.

Yours very respectfully,
H. E. BARNARD,
Chemist.

SOUTH LYNDEBOROUGH, N. H., July 26, 1903.

H. E. Barnard.

DEAR SIR:—The water analysis was received last evening. We thank you for the same. It will be a great help to us in the future. Our doctor thinks that if a galvanized iron pipe is put in there will be no more trouble from lead. Will you please write and tell us if it is all right to use that kind of pipe? If we use iron pipe will it rust clothes for washing, and is it any better than the first mentioned? The water does not stand in the pipe at all.

I remain respectfully yours,
MRS. WALTER C. PATTERSON.

STATE LABORATORY OF HYGIENE.

CONCORD, N. H., July 27, 1903.

Mrs. Walter C. Patterson, South Lyndeborough, N. H.

DEAR MADAM:—Your communication of the 26th inst. concerning the best kind of pipe suitable for use with your water supply is at hand, and I take pleasure in advising you as follows:

Galvanized iron pipe will be perfectly satisfactory. It will not cause zinc poisoning, and will not rust sufficiently to injure the water. It will wear longer than plain pipe, and is the most suitable pipe for conveying water supplies. It may be that for a short time after being laid the water will be milky and slightly greasy, due to the minute particles of zinc washed off the lining of the pipe. While this condition persists, it should not be used for drinking. You will have no trouble with the water, however, after the pipe has been in use for a few days.

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I shall be very glad to advise you further at any time. Trusting that you may be successful in securing a water supply free from lead and wholly suitable for drinking and domestic use, I am

Yours very respectfully,

H. E. BARNARD,
Chemist.

NEW HAMPTON, N. H., July 31, 1904.

To State Board of Health, Concord, N. H.

I desire to acknowledge thanks for courtesy of the board pertaining to sanitary water analysis, Lab. No. 2180.

The board would do myself and others of this town a great service if it would kindly suggest a variety of water pipe suitable for local conditions as indicated by the analysis. Is a galvanized-iron pipe, a tin-lined lead pipe, or a purely iron pipe the thing for us, or is there a more desirable variety unknown to us? Does a galvanized iron present the same sanitary objections as the lead we are now using? Some suggestions in this line from your honorable body would be a decided help.

With thanks in advance for your favor, I am

Very truly yours,

A. W. BACHELER.

STATE LABORATORY OF HYGIENE.

CONCORD, N. H., August 2, 1904.

Mr. A. W. Bacheler, New Hampton, N. H.

DEAR SIR:—Replying to your communication of the 31st utl., requesting advice as to the kind of pipe most suitable for conveying water like that analyzed under Lab. No. 2180, I am pleased to reply as follows:

If the expense does not become an important factor, the tin-lined lead pipe possesses many advantages over other pipes, as it is easily laid and very durable. Care should be taken to secure a good pipe, as some of the tin-lined pipes have been known to have a considerable proportion of lead in the lining.

Galvanized-iron pipe will prove quite satisfactory for your use. It will last longer than the plain iron, and will not become choked by corrosion and rust as quickly. The zinc coating does not render the water injurious, and poisoning by solution of the zinc by the water need not be feared. It is true that for a short time after the pipe is laid there will be a very considerable quantity of zinc washed out of the pipe, enough to color the water and render it turbid. The water should not be used until all the loose particles of adherent zinc have been washed out of the pipe, but after that it will give no more trouble.

It is to be regretted that a pipe which possesses the advantages of a lead pipe without the disadvantage of possible lead poisoning has never been placed on the market at a reasonable cost.

There are other pipes in use which are satisfactory, but which are not adapted to use in a small system. The cement-lined pipe is durable, safe and comparatively inexpensive, but the fact that it has to be made where it is to be laid because of breakage during shipment prevents its general use. The pitch-lined

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and coated iron pipes wear well, but are poorly adapted for conveying drinking water because of a decided taste they impart to the water.

You will undoubtedly be pleased with either the galvanized iron or tin-lined lead pipe. The last pipe is, perhaps, the more preferable, but its higher price is a weighty disadvantage.

Very truly yours,

H. E. BARNARD,
Chemist.

CHESHAM, N. H., August 7, 1904.

H. E. Barnard, B. S., Chemist State Board of Health.

DEAR SIR :—I thank you much for your analysis of my spring water, sample 2,238.

Will you now simply advise me what pipe to use in place of the present lead pipe—whether galvanized iron, or tin-lined lead, or what? and greatly oblige

Yours truly,

JAMES B. BELL.

STATE LABORATORY OF HYGIENE.

CONCORD, N. H., August 8, 1904.

Dr. James B. Bell, Chesham, N. H.

DEAR DOCTOR :—In reply to your query as to the best kind of pipe for use in conveying water like sample 2,238 I can advise you as follows :

If the matter of expense is not to be considered the tin-lined pipe is the most satisfactory pipe made. It is easily laid, very durable and entirely safe. The only objection to the tin-lined lead pipe is the first cost. Galvanized iron pipe is also satisfactory pipe and should be used instead of lead pipe whenever the more expensive tin-lined lead pipe is too costly. When first laid the adherent zinc particles will wash out of the pipe and will render the water turbid or milky for a time. This condition does not last long, however, and as soon as the water runs clear it will be entirely suitable for use.

The only other satisfactory pipe to be considered is the cement-lined iron pipe. Unfortunately this excellent pipe in point of length of service, cost and safety, has to be made on the spot where it is to be laid. And while the machinery necessary to make it is simple it is rarely possible to make use of it except when laying an extensive pipe system.

Very truly yours,

H. E. BARNARD,
Chemist.

SANBORNVILLE, N. H., August 17, 1904.

H. E. Barnard.

DEAR SIR :—I want to ask your advice as to the water in my well as per your analysis No. 2,264.

Is this water safe to drink? If not, what course would you advise me to take? The water-closet has a brick vault and is tight. The stable manure is about 60

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feet from well in barn cellar and is on a slope away from the well. Would cleaning out the well be of any use? Would you advise removing the lead pipe? The water I sent you had been standing in the pipe several hours. Would you like another sample of the water? If so please send me another container. If there is any charge for your advice in this matter let me know, for I want to correct this trouble if I can.

Very truly,

W. S. DAVIS, M. D.

STATE LABORATORY OF HYGIENE.

CONCORD, N. H., August 18, 1904.

Dr. W. S. Davis, Sanbornville, N. H.

DEAR DOCTOR:—By far the worst feature of your water is the presence of so much lead. The sewage pollution is of itself of little moment as all the sewage is oxidized and filtered before reaching the well.

If care is taken to keep the vault tight and all surface drainage turned away from the well I think you can anticipate no trouble from using the water. I should advise you to replace the lead pipe with galvanized iron or tin-lined lead pipe.

Very truly yours,

H. E. BARNARD,
Chemist.

CHESHAM, N. H., September 15, 1904.

Mr. H. E. Barnard.

DEAR SIR:—Thank you for the analysis of the well water No. 2,336, I sent you some days ago. May I trouble you further to tell me whether galvanized iron pipes would be suitable to use in conducting this water about 275 feet, or whether I should need tin-lined lead pipe?

Yours truly,

ISABELLE MAY.

STATE LABORATORY OF HYGENE.

CONCORD, N. H., September 16, 1904.

Miss Isabelle May, Chesham, N. H.

DEAR MADAM:—In reply to your inquiry of the 15th inst. concerning the kind of pipe most suitable with water which was analyzed under the number 2,336, I can advise you to use either galvanized iron or tin-lined pipe. Both are quite safe; the galvanized iron pipe is the cheaper but the tin-lined pipe is much more durable and is more easily laid. Trusting that the substitution of either of these pipes for the lead pipe now in use will solve for you the problem of pure water,

I am very truly yours,

H. E. BARNARD,
Chemist.

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THE NORMAL DISTRIBUTION OF CHLORINE IN NEW HAMPSHIRE WATERS.

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THE NORMAL DISTRIBUTION OF CHLORINE IN NEW HAMPSHIRE WATERS.

BY H. E. BARNARD.

Sanitary water analyses are made for the purpose of determining the potability of water, with special reference to proving the absence of sewage and polluting material that may contain disease germs.

The character of a water may be modified by excessive organic decomposition, by vegetable growths, by micro-organisms and by the influx of sewage and manufacturing waste. An excess of any one of these classes of impurities renders a water, normally potable, distasteful, unpleasant, and possibly unwholesome. Chemical analyses reveal the presence of decomposing organic matter and of abnormal quantities of the natural mineral constituents; biological examinations most readily determine the forms of algae and of micro-organisms. But a chemical analysis of a water often only partially shows its true character and results so obtained must be supplemented by microscopical and bacteriological examinations. On the other hand, the biologist may be able to prove the absence of disease germs and still fail to detect those characteristic changes of composition that are the surest signs of an abnormal water. The exact results of chemical analysis are therefore of first importance in revealing the true character of a water, and when a series of determinations, extending over a period of time, shows but slight departures from the normal condition, it may be assumed that the supply is free from pollution.

There are two principal factors determinable by chemical analysis that have much weight in proving the purity or impurity of a water: first, nitrogen, in the four forms of free ammonia, albuminoid ammonia or nitrogen present in organic combination, nitrites and nitrates; and, second, chlorine, in its combined form as common salt. The nitrogen may be present in the form of albuminoid ammonia, due to living micro-organisms or to decomposing organic matter, either animal or vegetable; as free ammonia and nitrites from decaying animal matter, animal and household wastes, etc., or it may be entirely oxidized through the various

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phases of free ammonia and nitrites to the harmless nitrates, thus changing it from organic life to inorganic matter, as salts of soda, lime and potash.

The presence of chlorine in a water is of greatest import in sanitary interpretation, as it is a factor which never misleads, and which, when intelligently considered, measures the contamination of a water in absolute terms.

Common salt, a combination of sodium and chlorine in the proportions of about two parts by weight of sodium to three of chlorine, is a necessity in the human and animal economy where it plays an important role in the blood and in many physiological processes.

But little of it is retained in the system, however, and, the chlorine, leaving the body with other wastes, is not appropriated by vegetation as are the nitrogen compounds, but as it is very soluble in water, remains there as a most useful indication of sewage pollution. The sources of chlorine are usually the sink drain, with its burden of salted water from domestic operations; the house drain, with its chlorine containing excreta, and the stable drain with but a slight chlorine content in comparison with the other two. Chlorine of itself is not harmful as it occurs in combination as salt. Its use to the chemist is due to the fact that its presence in water reveals a past or present history of pollution by some form of sewage.

Repeated investigations have established the fact that the amount of chlorine in any given body of water is directly proportional to the number of inhabitants upon its watershed. This is due to the fact that the amount of salt consumed is so constant that household sewage contains definite quantities. It is even claimed, and we have reason for supposing the theory true, that the population of any particular district may be very closely estimated from a determination of the chlorine content of the sewage effluents and run-off. Investigations conducted by the Massachusetts State Board of Health show that an increase of 28 persons per square mile raises the chlorine content for that section one tenth part. Calculations based on observations in England indicate that the amount of chlorine contributed to sewage by each individual is approximately .045 pounds per day. Broadly speaking, we may say that four families, or 20 persons per square mile, will add, on an average, .01 of a part of chlorine per 100,000 parts of water to the water flowing from this area, and that a very much smaller population will have the same effect during seasons of low flow.

It is well known that waters near the sea-coast normally contain considerable salt; that waters further inland have less salt, and that water

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far removed from the seaboard has a very slight chlorine content. The reason for this drop in chlorine content is due to the fact that all the salt present in normal waters comes from the ocean, being borne in by the winds as salt-laden moisture which is precipitated as rain. The amount present in any given locality is nearly constant, although along the seaboard it is somewhat influenced by the direction and force of the winds and the amount and distribution of the rainfall. Waters near salt deposits are, of course, liable to be influenced by this fact, and when such conditions obtain no normal chlorine content can be attributed to any water that comes in contact with salt beds. There are no such disturbing factors in New Hampshire, and whatever salt is present in the waters of the state is due to the proximity of the Atlantic Ocean.

The determination of the varying quantities of chlorine in the waters of any particular area is therefore necessary before intelligent analyses can be made. This is clearly illustrated by a comparison of the chlorine figures of normal waters in different parts of the state. The normal chlorine content of the waters of low-lying North Hampton, one half mile from the coast, is 2.95 parts per 100,000 parts of water, and of Rye 2.37 parts, while at Hanover, on the western border of the state, the normal chlorine is .07 parts. If, then, a well water at Hanover contains 0.40 parts of chlorine per 100,000 it contains but one seventh as much chlorine as the normal unpolluted water of North Hampton, and to one unacquainted with the conditions, judging from the chlorine content, would appear to be very pure. As a matter of fact it contains over five times as much chlorine as it should, and the excess is wholly due to the presence of sewage or sewage effluents.

The great importance of knowing the normal chlorine content is, therefore, an absolute necessity in the interpretation of water analyses and has led to the preparation of so-called chlorine maps, which show at a glance the amount of chlorine that should be present in water in any part of the territory mapped out. The State of Massachusetts did pioneer work along this line, and their chlorine map, prepared at a cost of many thousands of dollars, and as a result of a great many analyses, extending over a period of several years, has been of inestimable importance to sanitarians, not only of that state, but of other states and countries of the world.

New Hampshire waters had been but little studied before the State Laboratory of Hygiene was established. Since then, for a period of three and one half years, both public and private supplies have been under constant supervision. One of the first questions to be taken up was the determination of the normal chlorine content of the various waters,

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and to this end several hundred spring waters of known purity were analyzed during 1901–'02, and from figures so obtained a general idea was reached of the normal chlorine contents. The work has been continued until, after three and one half years, we have in our possession a sufficient number of analyses of unpolluted waters to warrant us in publishing a chlorine map of the state.

In preparing this map we have analyzed nearly 700 waters of known purity, collected from 142 towns located in every part of the state, but perhaps more numerous along the south and eastern borders. The chlorine contents so obtained are placed upon the map, and the corresponding figures, that is, figures which are the same in different sections, are connected by lines. These lines are very properly called isochlors (like chlorine), and upon their arrangement depends the value of the map. To draw properly these isochlors we have made repeated analyses of unpolluted spring waters taken at different seasons over the area to be covered. The chlorine content of all waters is liable to slight changes through the year, as it is influenced by the amount of rainfall and the severity of the storms which blow in off the Atlantic. But by taking the samples at different seasons we arrive at a fair average without difficulty. The largest amount of data has been obtained near the sea-coast, where the isochlors change rapidly. Areas exposed to the direct winds from the ocean receive the greatest amount of salt, and consequently those towns bordering our short coast have a high and varying chlorine content. For instance, in the town of North Hampton, located on the coast, a spring water one half mile from salt water contains 2.945 parts of chlorine per 100,000 parts of water, a water one and one half mile from the coast, 1.01 parts, and a water five miles inland, .81 parts. In going inland one mile from the coast the chlorine content dropped almost 2.00 parts, and in going still further inland four miles, the drop was but .20 of a part, or but one tenth of the drop of the first mile.

Waters in the northern and western part of the state do not show any evidence of being influenced by the storms which occasionally sweep inland from the Atlantic, and their chlorine content is as low as can be accurately determined. North of the White Mountains the content is below 0.05 parts per 100,000, and fully three fourths of the area of the state is within the region having a chlorine content of 0.10 parts or below.

It is interesting to note that Great Bay, which flows inland from Portsmouth for 20 or more miles, does not change the chlorine content of adjacent waters to any appreciable extent, although deep well waters near Great Bay and the salt Exeter River frequently show increased chlorine. This is due to the mingling of the brackish water of the river and bay

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with the natural ground water supply. In the analysis of waters from Exeter excessively high chlorine contents have been observed which could not have been due to any other cause.

It was impossible to make the very many determinations at stated distances inland necessary to fix the contents for the first few lines by analysis alone, and so in drawing the isochlors through Rockingham and Strafford counties in the southeastern part of the state we have followed the contour of the sea-coast, thus keeping different points between the isochlors at the same distances from the sea. As the results we obtained on the many samples analyzed accord with the position of the lines as established we feel that the isochlors are correct within very slight limits.

A departure from the normal of .05 parts per 100,000 within the area covered by the lines that fall within a few miles of each other is not unusual and does not invalidate the accuracy of the map. But after passing isochlor .25 the direct influence of the sea is not felt and the chlorine content diminished slowly, so that comparatively large areas are included. Besides drawing the isochlors we have arranged the normal chlorines of all the towns by counties, and it is noteworthy that in the counties of Grafton, Sullivan, Cheshire, Coös, Carroll and Belknap, the normal chlorine content does not vary throughout the county more than 0.05 parts per 100,000.

That the chlorine content of every town in the state may be borne in mind by persons who may not have access to the chlorine map we insert the following table. The results obtained by analysis of several samples of waters of known purity are given as observed chlorine. Where we obtained no satisfactory chlorines from a town we have calculated the normal chlorine from the map and insert the figures in black-faced type. In but few instances is the observed chlorine different from the normal chlorine, and both series of figures may be accepted as accurate within the limits of analytical error.

NORMAL AND OBSERVED CHLORINE OF THE TOWNS AND CITIES OF NEW HAMPSHIRE.

Black-faced figures indicate normal chlorine.

Acworth..... .08	Bath..... .05	Campton..... .06
Albany..... .08	Bedford..... .14	Canaan..... .07
Alexandria..... .06	Belmont..... .07	Candia..... .29
Allenstown..... .15	Bennington..... .08	Canterbury..... .11
Alstead..... .08	Benton..... .05	Carroll..... .05
Alton..... .12	Berlin..... .06	Center Harbor..... .09
Amherst..... .10	Bethlehem..... .05	Charlestown..... .08
Andover..... .07	Boscawen..... .09	Chatham..... .06
Antrim..... .10	Bow..... .14	Chester..... .39
Ashland..... .10	Bradford..... .09	Chesterfield..... .08
Atkinson..... .30	Brentwood..... .35	Chichester..... .10
Auburn..... .16	Bridgewater..... .07	Claremont..... .08
Barnstead..... .15	Bristol..... .07	Clarksville..... .04
Barrington..... .20	Brookfield..... .13	Colebrook..... .05
Bartlett..... .06	Brookline..... .14	Columbia..... .04

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Concord	12
Conway	.06
Cornish	.09
Croydon	.07
Dalton	.04
Danbury	.09
Danville	.25
Deerfield	.18
Deering	.06
Derry	.18
Dorchester	.07
Dover	.32
Dublin	.09
Dummer	.04
Dunbarton	.12
Durham	.88
East Kingston	.35
Easton	.05
Eaton	.08
Effingham	.06
Ellsworth	.07
Enfield	.05
Epping	.17
Epsom	.20
Errol	.04
Exeter	.32
Farmington	.20
Fitzwilliam	.10
Francestown	.10
Franconia	.05
Franklin	.10
Freedom	.08
Fremont	.24
Gilford	.10
Gilmanton	.07
Gilsum	.10
Goffstown	.14
Gorham	.07
Goshen	.07
Grafton	.07
Grantham	.11
Greenfield	.08
Greenland	1.27
Greenville	.11
Groton	.07
Hampstead	.26
Hampton	1.00
Hampton Falls	1.20
Hancock	.08
Hanover	.07
Harrisville	.07
Hart's Location	.05
Haverhill	.06
Hebron	.07
Henniker	.08
Hill	.10
Hillsborough	.07
Hinsdale	.12
Holderness	.05
Hollis	.13
Hooksett	.15
Hopkinton	.11
Hudson	.13
Jackson	.05
Jaffrey	.08
Jefferson	.04
Keene	.08
Kensington	.40
Kingston	.30
Laconia	.12
Lancaster	.05
Landaff	.05
Langdon	.08
Lebanon	.08
Lee	.30
Lempster	.07
Lincoln	.05
Lisbon	.07
Litchfield	.15
Littleton	.07
Livermore	.08
Londonderry	.17
Loudon	.09
Lyman	.04
Lyme	.07
Lyndeborough	.10
Madbury	.32
Madison	.08
Manchester	.13
Marlborough	.09
Marlow	.05
Mason	.11
Meredith	.10
Merrimack	.14
Middleton	.15
Milan	.08
Milford	.11
Milton	.18
Monroe	.04
Mont Vernon	.11
Moultonborough	.09
Nashua	.15
Nelson	.10
New Boston	.11
Newbury	.08
Newcastle	1.00
New Durham	.15
Newfields	.32
New Hampton	.06
Newington	.55
New Ipswich	.11
New London	.07
Newmarket	.32
Newport	.08
Newton	.36
Northfield	.10
North Hampton*	2.94
North Hampton†	1.61
North Hampton‡	.81
Northumberland	.04
Northwood	.22
Nottingham	.23
Orange	.08
Orford	.07
Ossipee	.08
Pelham	.19
Pembroke	.15
Peterborough	.10
Piermont	.06
Pittsburg	.04
Pittsfield	.15
Plainfield	.08
Plaistow	.30
Plymouth	.09
Portsmouth	1.07
Randolph	.05
Raymond	.20
Richmond	.10
Rindge	.10
Rochester	.21
Rollinsford	.28
Roxbury	.09
Rumney	.09
Rye	2.37
Salem	.24
Salisbury	.10
Sanbornton	.10
Sandown	.15
Sandwich	.08
Seabrook	.92
Sharon	.08
Shelburne	.06
Somersworth	.24
South Hampton	.43
Springfield	.10
Stark	.05
Stewartstown	.04
Stoddard	.09
Strafford	.18
Stratford	.05
Stratham	.67
Sullivan	.08
Sunapee	.07
Surry	.08
Sutton	.08
Swanzey	.10
Tamworth	.10
Temple	.10
Thornton	.06
Tilton	.10
Troy	.10
Tuftonborough	.10
Unity	.06
Wakefield	.12
Walpole	.06
Warner	.09
Warren	.07
Washington	.07
Waterville	.07
Weare	.12
Webster	.10
Wentworth	.10
Westmoreland	.07
Whitefield	.04
Wilmot	.09
Wilton	.11
Winchester	.09
Windham	.18
Wolfeborough	.08
Windsor	.09
Woodstock	.05

*One half mile from coast. †One and one half miles from coast. ‡Five miles from coast.

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COPPER SULPHATE TREATMENT OF HANOVER WATER SUPPLY.

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REPORT OF THE WORK DONE BY DR. H. N. KINGSFORD UPON THE WATER IN THE RESERVOIR OF THE HANOVER, N. H., WATER CO., WITH DR. G. T. MOORE'S COPPER SULPHATE TREATMENT, JULY 19, 1904.

For the past few years, during the warmer months, there have been many complaints from the people of Hanover regarding the bad taste and odor of the reservoir water. This odor and taste at times has been very offensive, especially when the water was warmed.

The odor was at times fishy, not the odor of decomposing fish, but an odor similar to that about a fish soon after it is caught; sometimes the odor was decidedly musty. The taste was not easily described; it had, as the majority of people expressed it, a "nasty taste." There was also a slight yellowish color to the water. Bacteriological investigation showed quite a number of different varieties of micro-organisms; a few of these produced slight colors on culture media and a few gave off an odor. The algæ were also cultivated and the odor produced by their growth was identical to the odor noticed in the water.

The facts were presented to the water board and the suggestion made that they apply Prof. G. T. Moore's copper sulphate treatment to the water, trusting the taste and odor would be improved.

After some delay because of slight objections entertained by some of the members of the water board, on July 19th, 1904, the application was made.

The water supply for the town of Hanover, New Hampshire, comes from a reservoir situated about three miles northeast of the post-office, 155 feet above the main street, covers about 33 acres, has a capacity of 136,000,000 gallons, is supplied by springs and brooks, and the water is carried to consumers through iron pipes. The reservoir has a water shed of a little less than 1,200 acres and was built in August-November, 1893.

On account of the gradual sloping of the banks of the reservoir, and the presence of many fish, a one to four-million solution was used instead of a one to one-million solution, as Professor Moore recommends. It was estimated that there were about 100,000,000 gallons of water in the reservoir at the time. The copper sulphate was weighed out into 25 pound lots. One lot was placed in a gunny sack which was held open by an iron spreader, the sack fastened at the top, and then attached to the stern of a rowboat. The boat was rowed back and forth across the reservoir, commencing where the water was deepest and ending along the edges where the water was shallow. This process was repeated along lines 25 to 30 feet apart until the whole area had been covered. The copper dissolved very quickly, the water being warm, which necessitated rowing rapidly

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while the sack was full and slowing up as the copper in the sack diminished.

Another small body of water was treated in the same way except in this case a one to one-million solution was used. No bacteriological examination had been made previous to the application to this smaller body of water. The application was made to this water as an experiment in reference to the effect upon the fish.

This body of water was quite shallow at the edges and about eight feet deep in the center. The application was made in both cases on the same day, betwen 10 a. m. and 3 p. m. The day was very warm, no wind, and a heavy thunder shower took place just as the work was finished.

The edges of the reservoir were inspected next morning and no dead fish were found, no odor was noticed, and many very small fishes were seen swimming about.

On the edges of the smaller body of water 86 small dead fish were picked up, the largest of these measuring one and one half inches in length. The appearance of these dead fish was very striking. Their abdomens were very much distended and many of them had buried their heads in the mud, and in all cases their eyes looked "popped out" from their sockets. No fish were seen which seemed to be injured. Quantities of fishes about two inches long, and from that size up to one foot long, were seen swimming about in the water apparently in a perfect state of health. Both bodies of water were inspected each morning for four days; no more dead fish were found and nothing remarkable was seen. There was no perceptible change in the appearance of the water. Samples were taken from the reservoir and from taps in town and examined for micro-organisms with the following results:

June, 1904 . . 1,800 micro-organisms, other than algæ, per c. c.
July 16, 1904 . . 2,600 micro-organisms, other than algæ, per c. c.

The above was tap water. Algæ not included in this table.

	Reservoir.	*Tap.*
July 20,	7 per c. c.	2,400 per c. c.
21,	5 "	400 "
22,	15 "	20 "
23,	20 "	15 "
30,	no examination.	40 "
August,	" "	500 "
September,	" "	986 "
October,	" "	840 "
November,	" "	800 "

Algæ, July 16th, 1904, large numbers from tap water.

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	Reservoir.	*Tap.*
July 20,	None.	Large numbers.
21,	"	Few.
22,	"	None.
23,	"	"

Last examination for algae was in August, when only a few grew on media.

The first day after the application the taste and odor had perceptibly diminished, and on the second day had disappeared altogether. The color also practically disappeared, and only a slight color reaction could be detected by delicate color tests. Chemical examination showed no trace of copper in the reservoir water. A sample was not examined from the small pond. No one in town except those immediately concerned in the work knew that anything was being done, but in two days after the treatment two different persons remarked upon the improvement and within a week no less than 11 individuals spoke of it. It is not generally known at this time that anything has been done to the water. Up to date there has been no bad taste, no color and no odor when cold. At times I think I can detect a very slight odor on close observation when the water is warm.

Conclusion: That the odor and taste were due to microscopic organisms. The color to a great extent was also due to micro-organisms. That the application of copper sulphate in the strength of one part to four millions of water is sufficient to destroy these organisms without injury to fish. That one part of copper sulphate to one million parts of water as found in the ordinary reservoirs and ponds will, in addition to destroying micro-organisms, destroy the small fish.

The probabilities are that if the water was of an equal depth in all parts of our reservoirs and ponds one part of copper sulphate to one million parts of water would not kill the fish, but as the edges are shallow and the bottom irregular, it is impossible to get an equal distribution of the solution until after the smaller fishes succumb. There can be no fixed general rule, each case must be treated as conditions require.

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THE INSPECTION AND CONTROL OF FOOD PRODUCTS IN NEW HAMPSHIRE.

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THE INSPECTION AND CONTROL OF FOOD PRODUCTS IN NEW HAMPSHIRE.

BY H. E. BARNARD, CHEMIST.

In the absence of national legislation on the subject it has remained for the several states to solve the problem of pure food as best they might. Inability of the individual state to interfere with interstate commerce has been one of the chief drawbacks to the framing of an entirely satisfactory pure food law. A state can, provided the means are afforded it, regulate the manufacture and sale of all home products. But when all other states are allowing the manufacture of impure goods it becomes an impossibility for any one state to keep such goods from coming over its borders. Notwithstanding this vital defect in the working of any local pure food law every state has some form of a food law on its statute books.

Pure food laws are a part of the police power of the state and as such are subject to the broadest interpretation. The extent to which a state may go to protect public health and prevent fraud is indefinable and unlimited. The laws are justified by the unquestioned fundamental right of the state to provide for the protection and preservation of health. Even before the enactment of special food laws it was an indictable offense to mix anything in the food made and supplied for human consumption which would be unwholesome and deleterious to health, and the wilful adulterating or mixing unwholesome ingredients in foods was considered an act dangerous to the public health and life and constituted a public nuisance.

The state food laws were first intended to prohibit the sale of foods injurious to health. The statutes were strictly drawn for this purpose and the courts have in all instances upheld them. This class of adulterations has been so rigidly restricted that its extent is much less than formerly, except in the cases of the use of antiseptics and coloring materials. The contention is made that the use of the extremely small quantities of antiseptics necessary to prevent fermentation and decay in no way imperils the life or health of the consumer. But the courts have held that "It is not the quantity but the nature of the substance which the act prohibits."

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By far the greater part of the adulteration of food is not an attack upon the health of the consumer, but an economic fraud, and consists in forcing upon him without his knowledge products different from what they purport to be,—lacking in valuable constituents or made from cheap ingredients so prepared as to counterfeit the genuine article. It is to the suppression of adulterations of this class that most recent legislation has been directed.

The control of the sale of food products in New Hampshire dates back only as far as 1860, when an enactment regulating the sale of impure milk, butter and cheese, became a law. At the same session a general food law, very similar in form to the one now in force, was enacted. The law forbade the adulteration of bread or any other food substance and was extended so as to cover drugs and liquors, under a penalty of fine or imprisonment. A law to regulate the sale of vinegar was passed in 1881 but was later stricken out on a revision of the statutes. In 1891 the present pure food law went into effect, supplanting with its provisions most of the earlier legislation, but incorporating into the body of the law several sections relating to the sale of liquor, etc., that were a part of the original law.

The present pure food law of this state is as follows:

ADULTERATIONS, AND THE SALE OF UNWHOLESOME FOODS AND POISONS.

(Chapter 269 of the Public Statutes.)

SECTION 1. No person shall sell, or offer for sale, any adulterated drug or substance to be used in the manner of medicine, or any adulterated article of food or substance to be used in the manner of food or drink.

SECT. 2. If any drug or substance used for medicine, sold under a name recognized by the United States Pharmacopœia, or in some other pharmacopœia, or other standard work of materia medica, differs materially from the standard of strength, quality or purity laid down in such work, or contains less of the active principle than is contained in the genuine article, weight for weight, or falls below the professed standard under which it is sold, it shall be deemed to be adulterated within the meaning of this chapter.

SECT. 3. *If any food or substance to be eaten or used in the manner of food or drink contains a less quantity of any valuable constituent than is contained in the genuine article, weight for weight, or contains any substance foreign to the well known article under whose name it is sold, or is colored, coated, polished or powdered, whereby damage is concealed, or contains any added poisonous ingredient, or consists wholly or partly of any decomposed, putrid or diseased substance, or has become offensive or injured from age or improper care, it shall be deemed to be adulterated within the meaning of this chapter.*

SECT. 4. Whoever fraudulently adulterates for the purpose of sale any article of food or drink, drug or medicine, or knowingly sells any fraudulently adulterated article of food or drink, drug or medicine, or any kind of diseased or unwholesome provisions as defined in this chapter, shall be imprisoned not exceeding one year, or be fined not exceeding four hundred dollars.

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SECT. 5. Every person offering or exposing for sale any drug or article of food within the meaning of this chapter, shall furnish to any analyst, or other officer duly appointed for the purpose, who shall apply to him for the same and tender him its value in money, a sample sufficient for the purpose of the analysis of such drug or article of food.

SECT. 6. Any person who has reason to doubt the purity or genuineness of any article of food which he has purchased, may send at his own expense a sealed sample of it to the State Board of Health for inspection. If upon examination the article appears to be adulterated, the board may obtain a certified sample of it, and should this sample prove to be adulterated, the board shall begin proceedings at once against the vendor.

SECT. 7. Whoever hinders, obstructs or in any way interferes with any inspector, analyst or other officer appointed hereunder, in the performance of his duty, shall be fined not exceeding fifty dollars for the first offense, and one hundred dollars for each subsequent offense.

SECT. 8. Before commencing the analysis of a sample, the analyst shall reserve a portion, which shall be sealed; and in case of a complaint or indictment, part of the reserved portion of the sample alleged to be adulterated shall, upon application, be delivered to the defendant or his attorney, and part to the secretary of the State Board of Health.

SECT. 9. The State Board of Health shall adopt such measures as it may deem necessary to facilitate the enforcement of this chapter, and for the collecting and examining of drugs and foods, articles of clothing, fabrics, wall paper or anything containing poisonous pigments or substances whereby the health of any person may be injured.

SECT. 10. Whoever adulterates, for the purpose of sale, any liquor used or intended for drink, with cocculus indicus, vitriol, grains of paradise, opium, alum, capsicus, copperas, laurel water, logwood, Brazil wood, cochineal, sugar of lead or any other substance which is poisonous or injurious to health, or knowingly sells any such liquor so adulterated, shall be fined not exceeding one thousand dollars, or be imprisoned not exceeding one year.

SECT. 11. Whoever kills, or causes to be killed, for the purpose of sale, a calf less than four weeks old, or knowingly sells, or has in possession with intent to sell, for food, the meat of any such calf, shall be fined not exceeding fifty dollars, or be imprisoned not exceeding thirty days or both.

SECT. 12. Any meat, unwholesome provisions or articles sold, kept or offered for sale, and any articles adulterated, in violation of any of the preceding sections, shall be forfeited.

SECT. 13. Every apothecary, druggist or other person who sells any arsenic, corrosive sublimate, nux vomica, strychnine or prussic acid, shall make a record of such sale in a book kept for that purpose, specifying the kind and quantity of the article sold, and the time when, and the name of the person to whom such sale is made, which record shall be open to all persons who may wish to examine the same.

SECT. 14. Any person who shall violate the provisions of the preceding section shall be fined not exceeding one hundred dollars.

SECT. 15. The two preceding sections shall not apply to physicians, in their prescriptions or their recipes to their patients.

SECT. 16. Any corporation, person, firm or agent who shall sell or offer for sale or exchange any woven fabric or paper containing arsenic in any form, or

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any article of dress or of household use composed wholly or in part of such woven fabric or paper, or any article of dress containing arsenic, shall, upon conviction thereof, be fined not exceeding one hundred dollars; *provided, however*, that this section shall not apply to dress goods or articles of dress containing not more than one one-hundredth grain nor to other material containing not more than one tenth grain of arsenic per square yard of the material. (Ch. 27, Laws of 1901.)

ADULTERATION OF CANDY PROHIBITED.

(Chapter 26, Laws of 1899.)

SECTION 1. No person shall, by himself, his servant or agent, or as the servant or agent of any other person or corporation, manufacture for sale, or knowingly sell or offer to sell, any candy adulterated by the admixture of terra alba, barytes, talc or any other mineral substance, by poisonous colors or flavors, or other ingredients deleterious or detrimental to health.

SECT. 2. Whoever violates any of the provisions of this act shall be punished by a fine not exceeding one hundred dollars ($100) nor less than fifty dollars ($50). The candy so adulterated shall be forfeited and destroyed under direction of the court.

SECT. 3. It is hereby made the duty of the prosecuting attorneys of this state to appear for the people and to attend to the prosecution of all complaints under this act in all the courts in their respective counties.

Under Section 9 the State Board of Health is made the legal authority for the enforcement of the law. But not until the establishment of the State Laboratory of Hygiene in 1901 was it possible to do more than to make occasional analyses of suspicious articles of food, so that, except for the work of the State Board of Agriculture, which with some success enforced the provisions of the oloemargarine law, until 1901 no practical measures had ever been taken to secure for the people of the state pure and wholesome food products.

During the first two years after the Laboratory of Hygiene was opened analyses of public and private water supplies occupied most of the time available for analytical work, so that it was not until the summer of 1903 that active enforcement of the pure food law was taken up. One of the first steps toward securing practical results in food work is in enlisting the interest and coöperation of all dealers in such products. And that our position in regard to carrying out the provisions of the law might be easily understood, in the issue of the *Sanitary Bulletin* for January, 1904, the State Board of Health published the following rulings:

FOOD STANDARDS AND DEFINITIONS.

RULINGS BY THE STATE BOARD OF HEALTH.

The laws relating to food products are so varied and the standards of composition so dissimilar among different states that for the guidance of manufacturers,

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jobbers and retailers the State Board of Health has made rulings which define and fix standards for all ordinary food stuffs.

These rulings furnish a definite basis for work in the enforcement of the "Pure Food Law," and are intended to anticipate any questions as to the attitude of the State Board of Health in regard to the application of the law to particular articles of food, and will be recognized as such at the State Laboratory of Hygiene. The definitions and standards here given are those advised by the United States Department of Agriculture, given in the United States Pharmacopœia, or after thorough investigation and trial adopted by many of the states.

Authority for such rulings is given the Board by section 9, chapter 269 of the Public Statutes, which reads as follows: "The State Board of Health shall adopt such measures as it may deem necessary to facilitate the enforcement of this chapter, and for the collection and examination of drugs and foods," etc.

DEFINITIONS:

I. Offering or exposing for sale or selling adulterated food is prohibited.

II. The term "food," as used herein, shall include confectionery, condiments, and all articles used for food or drink by man, and if there be more than one quality of any article of food known by the same name, the best quality thereof shall be furnished to the purchaser, unless he otherwise requests at the time of making such purchase, or unless he be notified at such sime of the inferior quality of the article delivered.

III. An article shall be deemed to be adulterated within the meaning of section 3, chapter 269 of the Public Statutes.

In the case of food: (a) If any substance or substances have been mixed with it so as to lower or depreciate or injuriously affect its quality, strength or purity; (b) if any inferior or cheaper substance or substances have been substituted, wholly or in part, for it; (c) if any valuable or necessary constituent or ingredient has been, wholly or in part, abstracted from it; (d) if it consists wholly or in part of any decomposed, putrid, or diseased substances, or has become offensive or injured from age or improper care; (e) if it is colored, coated, polished, or powdered, whereby damage is concealed, or if by any means it is made to appear better or of greater value than it really is; (f) if it contains any added poisonous or injurious ingredients, or any foreign substance.

ANTISEPTICS:

Salicylic acid, benzoic acid, boric acid, hydrofluoric acid, sulphurous acid and compounds of these acids; formaldehyde or formalin, and various mixtures known to the trade as "Freezine," "Iceine," "Formol," "Preservalines" of various kinds, etc., are antiseptics, and foods or food products containing them are adulterated.

The use of salt, sugar, vinegar, spices, saltpeter, and wood smoke, as employed in curing meat, is not prohibited.

BAKING POWDERS:

Baking powders must be of standard strength and quality.

BUTTER:

Standard butter is butter containing not less than eighty-two and one half (82.5) per cent. of butter fat. The use of harmless vegetable coloring matter is allowable.

BUTTER—RENOVATED OR PROCESS:

Standard renovated or process butter must contain not more than sixteen (16) per cent. of water, and at least eighty-two and one half (82.5) per cent of butter fat. Renovated or process butter must be so marked and must not be substituted for butter unless so requested by the purchaser.

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CANDY:

The use of poisonous colors or flavors or other injurious ingredients, the admixture of terra alba, barytes, talc, or other mineral substance to give weight and volume to the mass, is an adulteration.

CANNED GOODS:

Canned goods must bear the name and address of the packer. If dried before packing they must be labeled "SOAKED OR BLEACHED GOODS" in letters not less than two line pica in size. The sale of peas or other vegetables greened with copper is prohibited.

CATSUPS:

Catsups are preparations of tomato pulp and spices, and must contain no added coloring material or preservatives.

CHEESE:

Standard whole milk cheese, full cream cheese, or cream cheese is cheese containing, in the water free substance, not less than forty-eight (48) per cent. of butter fat. The use of harmless vegetable coloring matter is allowable. The use of preservatives other than salt is prohibited.

CIDER:

Cider is the unfermented juice of the apple. Any substitute for apple juice, or any added antiseptic constitutes an adulteration.

COFFEE:

Coffee must be true to name. It must not be coated or polished to conceal inferiority.

COFFEE COMPOUNDS:

Mixtures of cereals or other articles sold as substitutes for coffee must be sold as a mixture or compound under an original or coined name, and not under the name of any ingredient thereof.

CREAM:

Standard cream is cream containing not less than eighteen (18) per cent. of milk fat. Cream shall be produced wholly from pure milk and be free from added coloring matter, preservatives, or other additions of any kind.

FLAVORING EXTRACTS:

Bottles or packages containing extracts must bear the name and address of the manufacturer. Lemon extract shall contain at least five (5) per cent. of the pure oil of lemon dissolved in alcohol. Vanilla extract shall be made wholly from vanilla bean, and shall contain no artificial coloring. When other flavoring substances are used, such as vanillin, coumarin or tonka, the extract shall be labeled so as to show its true character. The label, "Compound Extract of Vanilla," will not be deemed sufficient notice of the composition of the article.

FLOUR:

Flour must be composed entirely of one single ground cereal. The admixture of other flours or materials constitutes an adulteration.

GLUTEN FLOUR:

Gluten flour is flour from which the starch has been washed, wholly or in part. Standard gluten flour must contain at least thirty (30) per cent. of proteids calculated by multiplying the nitrogen content by the factor 6.25, and not over forty-eight (48) per cent. of starch.

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FRUIT, JELLIES, FRUIT JAMS, PRESERVES, ETC.:

Fruit jellies, fruit butters, preserves, canned fruits, fruit conserves, confections, fruit juices and syrups, etc., must consist of the fruit specified on the label, preserved only with cane sugar, with or without the addition of glucose, and must not contain artificial flavors, coloring matters or preservatives. If such articles contain any substitute for the fruit, or any injurious material to make up bulk or weight, any artificial flavor, color or antiseptic, or any substance not naturally occurring in such fruit, except spices or other wholesome natural flavoring materials, they shall be considered to be adulterated.

HONEY:

Honey is the nectar of flowers and saccharine exudations of plants gathered by bees. Honey made by feeding bees glucose, sugar syrup or other saccharine substance is not pure honey. Adding glucose sugar or syrup to honey, or substituting these materials for honey constitutes an adulteration.

LARD:

Lard is the fat of swine, the fat being melted and separated from the flesh. Adding beef fat or stearine, cotton seed oil, or other substitutes for swine fat constitutes an adulteration. Lard must contain not less than ninety-nine (99) per cent. of fat.

MILK:

Milk must contain three and one half (3.5) per cent. of fat and thirteen (13) per cent. of milk solids, except in the months of April, May, June, July, August and September, when it must contain three (3) per cent. of fat and twelve (12) per cent. of milk solids. Milk must not be skimmed, colored, watered, preserved with antiseptics, or produced from sick or diseased cows, or cows fed upon the refuse of breweries or distilleries. Milk from which the cream has been removed may be sold as skimmed milk from vessels, cans or packages on which the words "Skimmed Milk" are distinctly marked in letters not less than one inch in length.

MAPLE SUGAR AND SYRUP:

Maple syrup and sugar must be true to name. The chief element of value in maple syrup and sugar is the maple flavor, and any admixture of other sugars is an adulteration.

MOLASSES AND SYRUPS:

All molasses and syrups are assumed to be made from the juice of cane or other sugar-producing plants, and any molasses or syrup containing starch sugar, glucose or corn syrup shall be considered to be adulterated. Glucose syrups or corn syrups may be sold when so marked.

OLEOMARGARINE:

Oleomargarine, butterine, or kindred compounds, or mixtures of these with butter cannot lawfully be sold if colored in imitation of butter.

OLIVE OIL:

Olive oil is the expressed oil of the olive. The substitution of other oils or fats for olive oil, either in part or in whole, constitutes an adulteration.

SAUSAGE:

Sausage must be prepared from the properly prepared edible parts of animals, and must contain no preservative other than sugar, salt, saltpeter, smoke and condiments and no artificial coloring matter.

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SPICES:

Spices are aromatic vegetable substances used for the seasoning of food. Standard spices are sound spices, true to name, from which no portion of volatile oil or other flavoring principal has been removed. All spices must be pure. Any mixture of any foreign article with any spice is an adulteration.*

SUGAR:

Standard sugar is white sugar containing at least ninety-nine and one half (99.5) per cent. of sucrose and without any added substance.

TEA:

Tea consists of the dried leaves of the true tea plant, without addition of artificial coloring matter or filler, or extraction of essential properties. Any article offered for tea which does not conform to this definition is adulterated.

VINEGAR:

Vinegar shall contain no artificial coloring matter, and shall have an acidity equal to the presence of not less than four and one half (4.5) per cent. by weight of absolute acetic acid. Cider vinegar shall, in addition, contain not less than two (2) per cent. by weight of cider vinegar solids. If vinegar contains any artificial coloring matter, or less than the required amount of acidity, or if cider vinegar contains less than the required amount of acidity or cider vinegar solids, it shall be deemed to be adulterated.

METHODS EMPLOYED IN THE ENFORCEMENT OF THE PURE FOOD LAW.

All samples of food or food products that are suspected of being of inferior quality, or in any way different from what they purport to be, may be sent to the Laboratory of Hygiene for analysis by any resident of the state provided the sample is an original package. But, as the number of samples received from grocers and consumers is small and but poorly represents the class of food products on our markets, we make personal collections of samples throughout the state. It is the desire of the board to canvass the state thoroughly each year and to visit the larger cities as frequently as may be necessary to familiarize the grocers with the vigor of the enforcement. When a sample of food is received at the laboratory it is given a serial number and entered on the records under its name and brand, including the name and address of the manufacturer or wholesaler, the firm from whom collected, date of collection and name of collector.

If the sample proves to be pure and of good quality, the dealers are so notified and are given the results of the analysis. Upon the discovery of an article that does not meet the requirements of the Public Statutes of New Hampshire, the following warning notice is sent to the parties from whom that particular specimen was obtained:

*A preparation of mustard, vinegar, spices and enough filling of starch to make a mustard of mild flavor, to meet a legitimate demand which undoubtedly exists, may be sold as "French Mustard," or "Prepared Mustard."

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THE STATE OF NEW HAMPSHIRE.

OFFICE OF THE STATE BOARD OF HEALTH.

WARNING NOTICE.

To ——— ———:

You are hereby notified that a sample of ——— was bought at your place of business on ———, 190 , and upon examination of same at the

STATE LABORATORY OF HYGIENE,

Mr. H. E. Barnard, Chemist,

it was found to be in violation of the provisions of Chapter 269 of the Public Statutes of the State of New Hampshire.

The article referred to was adulterated with ———.

The further sale of said article if found to be adulterated will be deemed sufficient grounds upon which to begin legal action for the violation of the law.

Per order of State Board of Health,

——— ———, *Secretary.*

Concord, N. H., ———, 190 .

The above notice is accompanied by the following:

THE STATE OF NEW HAMPSHIRE.

OFFICE OF THE STATE BOARD OF HEALTH.

NOTE CONCERNING THE SALE OF ADULTERATED FOODS.

The "Warning Notice" sent to dealers, when articles bought of them are found to be adulterated or do not meet the requirements of the law, is not to be regarded as any reflection on their honesty and integrity. It simply informs them of the fact that a certain article is not up to the standard established by the Public Statutes, and thus warns them against the purchase and sale of the same.

We believe that an overwhelming majority of dealers are honest men, who would not offer for sale any class of goods known to be adulterated or prohibited by law; and that they will heartily coöperate with the board in its effort to suppress the sale of adulterated foods, drinks, drugs, etc.

We propose, as far as possible, to protect the dealers against these commercial frauds by giving information concerning their nature, and the public against the deleterious effects of this class of goods.

We would suggest that dealers, whenever they have a suspicion as to the quality of goods, should specify when ordering from the wholesale or jobber that said articles must not be adultered and must meet the requirements of the laws of the state of New Hampshire.

Food products to which preservatives have been added cannot legally be sold in this state.

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In addition to notifying the dealer that a certain article is adultered the results of the analysis are published in the *Sanitary Bulletin* and so reach the eye of every dealer in food products in the state, and as well of many consumers. The effect of this publication is to shut out of the market, within a very short time, all proscribed goods. The dealer, once notified of the quality of any brand of goods refuses to sell it, both because he does not wish to incur the penalty of the law and because he is anxious to supply only pure articles to his customers. And when a firm that does an illegal business in manufacturing or jobbing adulterated goods finds it impossible to sell the proscribed brands it leaves the field and is quickly supplanted by the honest trader.

This method of notification and publication is working excellently, and but few prosecutions have ever been necessary, and then only in the case of the adulteration of milk by the use of preservatives. We believe that it is far more essential to secure the good will and active coöperation of the tradesmen in food products than to invite their antagonism by ill-advised prosecutions in cases of unintentional violation of the law. We have endeavored to protect the honest grocer from the impositions of dishonest manufacturers and to assist him in keeping a stock, as far as possible, free from unlawful goods. The ready response of the firms we have visited to our suggestions that they withdraw from sale and return goods that have been found to be in violation of the law goes far to show that when the office of the State Laboratory of Hygiene in detecting the adulteration of foods is thoroughly appreciated by the dealers, we shall have little difficulty in keeping our markets free from impure products.

The State Board of Health appreciates fully the valuable assistance rendered by the members of local boards of health and by health officers in collecting samples of food products for analysis and in serving notices to dealers in adulterated goods. It would be impossible to enforce effectively the pure food law without this willing coöperation. It is the desire of the board still further to enlist the aid of the local officials and eventually to establish a system of local inspection that will constantly be in touch with all features of food distribution.

REPORT OF WORK IN FOOD LABORATORY.

In the absence of a regular food inspector we have made personal collections of food samples carried in stock by the retailers in the cities of Manchester, Concord, Nashua, Dover and Keene, and in several of the larger towns. This necessarily limited inspection, confined to but a small portion of the state, does not bring the work of the laboratory before the

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retailer and consumer in our other cities and towns as prominently as we should like. The samples of food collected, however, probably represent fairly well the standard of quality of food products offered for sale throughout the state. The results of our analyses bear out only too well the often repeated statement of the salesmen of the wholesale houses that "New Hampshire is a dumping-ground for adulterated foods." We are glad to say that the enforcement of our Pure Food law, which has remained so long unobserved on our statute books as to become a dead letter in the eyes of the manufacturer, has aroused to a remarkable extent his latent conscience, as well as that of the wholesaler and retailer, so that there now seems to be an honest desire on their part to comply with all the rulings of the State Board of Health concerning our law.

By correspondence and personal inquiry we have brought the laboratory in touch with most of the houses that cater to the New Hampshire trade. In this way, and through the distribution of information regarding the brands of adulterated foods through the *Sanitary Bulletin*, we have accomplished much in an educational way, and laid a foundation for a gradual improvement in the quality of the food products on our markets.

Of the 1,292 articles examined 513 were adulterated or varied from the legal standard. This is equivalent to an adulteration of 39.77 per cent. It must be remembered, however, that in collecting samples for analysis care was taken to collect articles of a suspicious character. Therefore, the extent of adulteration of all food products is not shown by this figure, and is represented by a much smaller percentage.

BOTTLED BEVERAGES.

During the summer months large quantities of soft drinks, carbonated waters, syrups and fruit juices are consumed. The demand for such beverages has created a large business in bottled goods and has prompted the manufacture of a great variety of products. Broadly speaking, however, they can be classed as follows: Carbonated waters, colored and flavored; root beers, combinations of syrups and extracts of herbaceous plants; and fruit juices, such as grape juice and lime juice.

We have found that the grape juices were usually pure, free from added color and preservatives. However, two of the samples of grape juice examined were highly fermented and contained from 5.84 per cent. to 7.17 per cent. of alcohol, thus putting them into the class of wines. This fermentation had taken place in one instance in the presence of salicylic acid. The fact that both brands were the product of the same house renders it probable that the manufacturer was attempting to sell a low grade wine of very inferior quality as unfermented grape juice. The amount of

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alcohol present, however, readily discloses the true character of the article. The lime juices are all much below the standard acidity and had been diluted by adding from two to three volumes of water. They were generally preserved with salicylic acid, although in one instance benzoate of soda was employed for the purpose.

It is apparent that the use of preservatives, usually salicylic acid, though benzoate of soda is frequently employed, is very common among manufacturers of fruit syrups. Coal tar dyes are also freely used to impart an attractive and realistic color to the drink. The flavors employed in the carbonated beverages are frequently synthetic ethers. The percentage of adulteration of this class of products was very high. Of 36 samples analyzed, 23, or 63.9 per cent., were adulterated by the use of preservatives or coal tar dyes, or both. [See analytical report, page 188.]

BUTTER.

Of the two samples examined, one was found to be oleomargarine. As heretofore, the inspection of butter will be made by the State Board of Agriculture and only occasional samples will be examined by us.

RENOVATED BUTTER AND OLEOMARGARINE.

The samples of renovated butter and oleomargarine were found to be free from coloring matter and to contain only the quantity of water allowed by law. It appears, however, that the manufacturers of these products are using great skill in incorporating all the water allowable. In one instance a renovated butter contained 15.98 per cent. of water, or but .02 per cent. less than the legal limit.

There is no doubt but that much renovated butter is sold to boarding-houses where it is served instead of genuine butter. Such practices are felt both by the consumer of the product and by the maker of genuine butter, and can only be stopped by rigid enforcement of the Federal law.

CANNED FRUITS, JELLIES AND JAMS.

Under this heading is included all the products made from fruit and sugar, either cane or glucose, and including fruit butters, preserves, fruit juices and syrups.

The base of the imitation fruit jelly, jam, etc., is apple juice or apple pulp, obtained principally from the waste parings and cores of the apple drying or evaporated apple factory. These waste products are partially dried at the factory, packed in bales or barrels, and shipped to the manufacturer of fruit products at a very low cost. Upon arriving at the factory the stock is boiled for a time in open kettles and then placed in large,

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closed, copper kettles and heated by blowing with superheated steam until the clear apple juice drains out of the mass to the bottom of the kettle. It is then drawn off into tanks and serves as stock for making all varieties of jellies and preserved fruits.

For the production of a satisfactory jelly or jam large quantities of sugar are necessary for jellifying and preserving the fruit. The cost of this sugar contributes largely to the cost of manufacture. Cheaper sugars in the form of glucose and glucose syrup are therefore employed as a substitute for cane sugar. Glucose is a wholesome and nutritious article of food and no objection can be made to its use except that products containing it are sold at prices not warranted by their actual cost. In some cases saccharine, a coal tar product of no food value but of great sweetening power, is used where a very sweet article is desired. Saccharine has antiseptic properties which make its use profitable. Its influence on the system is not determined and its employment is not allowable.

The apple juice and glucose syrup are mixed in the necessary proportions, colored with a coal tar dye to counterfeit the genuine product; flavored with compound ethers,—the synthetic fruit ethers technically known as ethyl buterate, amyl acetate, etc.; preserved by the addition of benzoate or salicylate of soda, and ultimately placed upon the market as pure currant, raspberry, or strawberry jelly.

Foreign coloring matter is employed in preparing fruit products for two reasons: one is that the color of fruit is not very stable and is liable to be destroyed during the process of preserving, and, furthermore, that goods packed in glass will lose their color when constantly exposed to the light on the grocer's shelves. The other reason for the use of dye colors is that they enable the manufacturer to use fruit of deficient color and thus to conceal inferiority. Apple stock uncolored is readily distinguished, but when dyed a brilliant crimson passes to the eye of the inexperienced buyer for the genuine fruit color. The preservation of this color is important, as the value of a jelly or jam for table use or in the sick room is doubtless enhanced by the attractiveness of its coloring, but the possibility for deception as to quality and purity afforded by the use of coloring matter overbalances any argument in its favor. By the judicious use of coal tar colors apple jellies flavored with small quantities of the true fruit, or by the artificial fruit ethers, can be given the appearance of the genuine article, or a cheap fruit or a vegetable pulp can be mixed into a jam, and jellies made from glucose and starch may be served to consumers who demand pure goods.

The harmfulness of the coal tar dyes depends on their composition. Many of them are quite innocuous, but are always liable to contain metal-

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lic impurities such as zinc, copper, tin, lead, and arsenic retained during the process of manufacture. Others are distinctly injurious and entirely unsuitable for use in food products.

The use of preservatives in packing fruit products is almost universal. Salicylic acid and its sodium salt has been most frequently employed, but within the last few years benzoate of soda has supplanted it as a preservative, because its physiological effects are less marked and possibly less generally known. Borax or boric acid, formaldehyde and the sulphites are also met with. It appears to be the custom of the manufacturer to pack away large quantities of semi-raw material in barrels during the fruit season to be worked up into marketable products during the winter months when the trade demands are most active. The bulk goods do not contain enough sugar to preserve them and the barrels and casks are not hermetically sealed, but the use of these vigorous antiseptics effectually prevents any fermentation taking place. It is argued by the manufacturers that the quantities of preservatives employed are so small that they cannot possibly affect the human system, and that the ingestion of fermented food products is far more injurious than the traces of preservatives necessary to prevent the action of the ferments. Their employment in food products, however, on this plea, or any other, is to be unequivocally condemned. The consumer has the right to demand that drugs be administered to him only with his knowledge and consent and in such quantities as his physician may prescribe. It cannot be gainsaid that a preservative active enough to arrest fermentative action in a food product, so carelessly packed as to be constantly exposed to infection, will as surely arrest, in a like manner, the action of the digestive ferments when the food is taken into the stomach.

The cheap food products have undoubtedly become a necessity in the homes of the poor, where they have supplanted, to a large degree, more costly forms of food. But the apparent demand for low priced food does not amount to a license to the manufacturer to place adulterated goods on our market nor authorize him to lower, still further, the cost of production by making entirely fraudulent articles that could not command a sale at any price if honestly labeled and sold for what they were.

The custom of labeling jellies made from apple stock with some trade name that does not in any way lead the purchaser to suppose he is getting something which he is not is becoming more common. The sale of the cheap and wholesome apple jellies is thus placed on an honest basis and relieves the trade of the responsibility incurred by meeting the demand for cheap goods with base imitations.

The ruling of the State Board of Health on this subject is as follows:

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Fruit jellies, fruit butters, preserves, canned fruits, fruit conserves, confections, fruit juices and syrups, etc., must consist of the fruit specified on the label, preserved only with cane sugar, with or without the addition of glucose, and must not contain artificial flavors, coloring matter, or preservatives. If such articles contain any substitute for the fruit, or any injurious material to make bulk or weight, any artificial flavor, color, or antiseptic, or any substance not naturally occurring in such fruit except spices or other wholesome natural flavoring materials, they shall be considered to be adulterated. [See analytical report, page 189.]

CANNED GOODS, MISCELLANEOUS PRODUCTS.

Canned goods, including canned corn, tomatoes, beans, soups, and prepared foods, such as clam chowder, corned beef hash, baked beans, etc., are, for the most part, free from adulteration. The use of preservatives is occasionally noted, but in a lesser degree than formerly. Canned meats are usually pure products. The frequent statement that the high color of canned meats is due to coloring matter is undoubtedly an error. The finely ground meats, like deviled ham, veal loaf, etc., occasionally contain borax, presumably added to prevent souring while in the process of manufacture.

Canned peas, greened with copper, are occasionally met with, and canned corn is frequently sweetened with saccharine. Soaked goods, that is, dried peas, beans, corn, etc., that have been soaked out to their original size and appearance, sometimes appear on the market when prices are high. Unusual quantities of tin have been found in some classes of goods, and it is recommended that only the highest grade of tin plate be used in making tin cans; that no zinc chloride be used in soldering, and that no solder be in contact with the contents of the can.

COFFEE, CHOCOLATE AND COCOA.

The articles of this class have been pure. The sale of adulterated coffee is apparently a thing of the past, although the misbranding of cheap Central American and Brazilian coffees as genuine Mocha and Java is very common. Cocoas and chocolate are subject to adulteration with starch and flour and undue amounts of the outer covering of the cocoa bean. [See analytical report, page 190.]

CONDENSED MILK.

Condensed milk is made by evaporating whole milk to one half or one third its original volume and adding cane sugar. In reporting the results of the analysis of the several samples we have given the amount of fat present in the condensed sample and also shown the percentage of fat in

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the original milk. The results show that every sample examined was made from normal, whole milk. A single sample labeled "Evaporated Cream" was analyzed. This name is usually applied to evaporated milks to which no sugar is added. The analysis showed that the product was made from ordinary milk and in no sense was it a condensed cream. The use of the term "Condensed Cream," when applied to the product produced by evaporating whole milk is an attempt to deceive and is not allowable. [See analytical report, page 191.]

CREAM OF TARTAR AND BAKING POWDERS.

There is no standard of purity for these preparations in New Hampshire, and no law exists compelling manufacturers to mark their products with the name and percentage of their ingredients. The value of a baking powder is determined by its ability to bring about the leavening of bread as a result of the liberation of carbon dioxide by an acid salt. We have, therefore, attempted to determine the relative value of various powders by comparing the amount of available carbon dioxide contained in them. Our results show that several times as much baking powder of low grade must be taken to produce equal results with a good article, and that the high grade baking powder thus becomes the most economical in use. If a baking powder evolves 10 per cent. of its own weight of carbon dioxide when brought into contact with water it is of good quality. Several samples of cream of tartar were found to be grossly adulterated, in two instances containing no acid potassium tartrate whatever.

HONEY.

Honey, both in the comb and strained, finds a large sale, especially in the cities. The comb honey is undoubtedly pure; much of the strained honey is wholly or partially artificial. Samples of "Orange Blossom Honey," guaranteed "strictly pure," and of "Pure Extracted Honey" have been found to consist entirely of glucose or corn syrup. One sample of "Pure California Honey" marked, "This honey contains a small amount of cane sugar, added to prevent crystallization," contained nearly 40 per cent. of cane sugar. Honey compounds purporting to contain from 25 to 50 per cent. of honey proved to be corn syrup in which a piece of extracted honeycomb was immersed. Many of the honeys passed as pure gave polarimetric readings considerably higher than we have observed when working on honeys of known purity, and may be adulterated with invert sugar, either introduced directly, or by feeding the bees cane sugar. [See analytical report, page 191.]

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LARD AND LARD COMPOUNDS.

Our analyses have shown that much of the lard represented as pure lard or pure leaf lard contains small quantities of beef stearine, apparently added to stiffen the product by raising its melting point.

Pure lard must be made from the melted fat of the hog, and contain no added ingredients. The incorporation of beef stearine, lamb suet or any other stiffener constitutes an adulteration. The compound lards, made from cottonseed oil, beef stearine and lard, are wholesome products, but labeling a mixture of cottonseed oil and beef stearine "Compound Lard" or "Lard Compound" is a misrepresentation of the facts, and constitutes an adulteration.

LEMON EXTRACTS.

In the analysis of lemon essences or extracts we have required that at least five per cent. of pure lemon oil should be present. Many terpeneless lemon extracts are sold as pure extracts, but as they contain no lemon oil must be considered to be adulterated.

The action of certain manufacturers of flavoring extracts in attempting to override the standard which we have adopted for lemon extract by claiming that their products, made from citral, or with a "washed out oil," are pure lemon oil and therefore not adulterated, calls for special attention on the part of wholesalers and retailers to the fact that our standard for lemon extract reads as follows:

> Lemon extract shall contain at least five per cent. of the pure oil of lemon dissolved in alcohol.

Under this ruling, which is in accordance with the standard set by the U. S. Pharmacopœia and by all the states that have adopted a standard, the extracts made from the "terpeneless" lemon oil and from "washed out oil" must be considered to be adulterated. While oil of lemon owes much of its characteristic aroma to citral, it is none the less true that lemon extract, as we know it, does not depend for its flavor on the citral alone, but that its character is influenced to a considerable degree by the terpenes present in normal oil of lemon. Limonene, the chief terpene of lemon oil, is an essential constituent, and when blended with the citral gives the true flavor of lemon.

To claim that extract made from citral and "washed out oil" is made from lemon oil is as fallacious as the statement of the vinegar manufacturer that his compound of acetic acid, water and color is cider vinegar because the acetic acid content is present.

When we first analyzed the lemon extracts on our markets we found that several brands that we had supposed to be of high grade were low in

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lemon oil content. Inquiry revealed the fact that the manufacturers were using citral, in part, in their formula. It is to the credit of these firms that when notified of the standard we had set for lemon extracts they immediately changed their formulas and are now sending to their retailers a high grade product, wholly in accordance with our law. It is the custom of the larger houses who have established a reputation on the quality of their goods to put out a cheaper, low grade article under a misleading name to compete with the products of other firms. This practice has flooded the state with ten-cent goods, entirely artificial and of almost no value as a flavoring, and yet costing as much for mixing, packing advertising and selling as the high grade article. We shall endeavor to assist the producers of legal products in driving these cheap, adulterated articles from the market. Thirty-four of the 53 samples of lemon extract were adulterated, a percentage of adulteration of 64.1 per cent. [See analytical report, page 192.]

MAPLE SYRUP.

If every farmer in New Hampshire owned a grove of maple trees and made each spring all the maple sugar and syrup possible, the amount produced would hardly equal the quantity sold each year as pure maple sugar or syrup. It is undoubtedly true that even in New Hampshire, a large producer of maple products, four fifths of the sugar and syrup sold in our markets is wholly or in part fraudulent. An inspection of three maple syrup bottling houses in the city of Manchester which were producing large quantities of "pure maple syrup," showed that their product was a dilute cane syrup colored with caramel, to which about 20 per cent. of melted maple sugar had been added. Another manufacturer had dispensed with maple sugar entirely, and was branding a mixture of cane syrup and corn syrup as "Pure Maple Syrup." A sample of "Cream Maple Sugar" selling for a high price as a superior article proved to be brown sugar and glucose. It matters not whether the maple syrup is made direct from the unadulterated sap of the maple tree or by remelting a sugar which has been made from a syrup, the product of such an unadulterated sap. We cannot consider, however, every syrup a maple syrup because it may have been made from what purports to be a maple sugar. Our analyses have shown that syrups bottled by houses of the highest reputation and guaranteed by them to be pure undoubtedly have been made from adulterated sugar.

We have analyzed several samples of maple syrup of known purity for the purpose of obtaining data for comparison when working with syrups of unknown quality. The greatly increased ash content of the true syrup over that of the cane sugar syrup is very noticeable, and offers most val-

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uable information as to the character of the syrup. Hortvet's method for the examination of maple sugar and syrup has also been employed with good results. We are now in possession of entirely satisfactory methods for detecting the use of syrups other than maple, and shall hope to publish soon the results of the examination of a large number of brands of syrup purporting to be pure. [See analytical report, page 193.]

MILK.

A systematic inspection of milk has been undertaken, and because of the coöperation of local health boards, who are empowered by law to appoint milk inspectors to collect samples for analysis, is demonstrating the value of rigid inspection of the milk supply in preventing adulteration.

The inspectors of the different towns and cities who are collecting samples of milk for analysis at the Laboratory of Hygiene are furnished with the necessary bottles, blanks, tags, etc., and are instructed to collect samples of milk from all dealers in the town and ship directly to the laboratory by express. We have endeavored to examine in this way the milk from the several cities and towns a number of times a year, more especially in the summer when the inducement to use preservatives is the greatest.

During the summer months very few samples of milk have been examined which fell below the standard as established by law; but after the change of standard from 12 per cent. to 13 per cent. of total solids on the first of October, a large number of samples have been examined which contained the required amount of milk fat, but which were from 0.5 per cent. to 1 per cent. low in milk solids. This condition has been particularly noticeable in milk from Holstein cows. One herd of 16 cows included but one cow whose milk contained normal solids, though all the samples had the required amount of fat.

Three hundred and seventy-one samples of milk and cream have been analyzed in the last two years, and of that number 111 were below the legal standard, an adulteration of 30.0 per cent.

But few samples were adulterated by the use of preservatives. In one instance of flagrant violation of the law in this respect the dealer has been held to await the action of the superior court.

One sample of cream examined was found to contain gelatine, added to stiffen the cream and thus simulate a very rich product.

MOLASSES.

Molasses is made from the juice of cane or other sugar producing plants, and is commonly understood to be the liquid material draining

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from granulated sugar made from sugar cane, either by natural percolation or by being treated in centrifugal machines. The commercial term, molasses, however, applies to other syrups, including that made from sorghum. The perfection of sugar making processes has increased the amount of cane sugar obtainable from a given quantity of juice and consequently diminished the molasses residue.

With the diminishing of the quantity the quality of the molasses has also depreciated until frequently it is unsuitable for table use. It has become a common custom, for that reason, to add glucose, or corn syrup, to these dark, strong residuums, and thereby produce a lighter colored and more attractive syrup, of fine body and flavor.

While this addition produces an article of increased value from a commercial standpoint, the use of glucose in improving the grade of molasses is considered by all authorities to be an adulteration, and is prohibited by our law.

Of 51 samples analyzed 16 contained glucose in quantities varying from 13 to 42 per cent. One sample contained but 13 per cent. of sucrose to 42.5 per cent. of glucose. [See analytical report, page 193.]

OLIVE OIL.

The adulteration of olive oil is by no means as extensive as is generally believed. We have found but few samples purporting to be olive oil to be impure. These few samples, labeled "Huile d'Olive" with foreign trademark, are wholly cottonseed oil, and were made in this country.

OYSTERS.

During the fall of 1903 samples of tub oysters were collected in the cities of Dover, Portsmouth, Manchester and Concord, and the results obtained showed conclusively that it was the practice of Boston wholesalers to add boric acid, or a preparation known as "Preservaline" to every tub of oysters they sent out. A vigorous correspondence with dealers in Norfolk and Providence River tub oysters produced such beneficial results that later inspections of samples collected from the same dealers in most cases showed no preservatives. But after a lapse of several months the old practice was resumed and boric acid again appeared in many samples, showing that the temptation to use preservatives instead of ice had been too great for the wholesalers to withstand.

The results of the extended investigations of the effect of borax on the human system have shown conclusively that its use is injurious, even to healthy persons. Of course the harmful effects of the drugs are accentuated when introduced into a supposedly nourishing oyster broth, or in

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the many forms in which oysters are employed in the sick dietary, as food for the weak and invalid.

One hundred and twenty-three samples of oysters were examined for borax, and in 50 cases it was found. Many samples of clams have also contained borax. [See analytical report, page 194.]

SAUSAGE.

Twelve of the thirteen samples of prepared meats known as sausage were adulterated with borax. The use of borax in these meat products is very common, as the manufacturer, by its use, is able to keep in a fresh condition the scraps which are finally worked up as sausage.

The employment of borax or any other preservative for this purpose is a violation of the Pure Food law.

In one instance a sausage, supposed to be pure, contained borax, which was found to have been introduced in a "sausage filler," consisting largely of starch, used to make the sausage less fat.

SPICES.

Forty-five samples of spices have been analyzed and but five were adulterated. The custom of employing makeweights of ground bark, sawdust, flour, etc., is evidently a thing of the past. While bulk goods may sometimes still be of poor quality, it is apparent that the trade favors the use of the small package or carton and that the manufacturer is using his name more and more on his products, thus guaranteeing, in a measure, the quality of the goods by the reputation of the house. One sample marked "Gold Label Mustard" consisted of wheat flour and ground mustard hulls colored with tumeric.

TOMATO KETCHUPS.

By far the greater number of the brands of tomato ketchups are adulterated either by coloring matter or preservatives or both. Recent analyses, however, lead us to believe that certain houses are now bottling a tomato ketchup free from added color and preservatives. While it is claimed by other manufacturers that goods so packed will prove objectionable to the consumer because of their lack of color and liability to ferment, we do not believe that the public will allow its natural prejudice in favor of pure foods to be overcome by the absence of the high color. If the open bottle is put in a cool place there is no danger of its fermenting before it is used up.

But five of the 36 samples of tomato ketchup analyzed were pure. [See analytical report, page 195.]

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VANILLA EXTRACTS.

A true vanilla extract is made by macerating the vanilla bean with sugar and extracting the mass with diluted alcohol. Adulteration of vanilla extract consists of substituting, wholly or in part, the inferior and cheaper tonka bean for the vanilla bean, or the addition of the artificial coumarin to weak extracts of the true bean or even preparing solutions of artificial vanillin or artificial coumarin in dilute alcohol, colored with caramel or coal tar dye to represent the true extract. As in the case of lemon extracts we have ruled that the only vanilla extract salable under our law is a pure extract prepared according to the Pharmacopœia formula. Compounds bearing on any part of their label the word "Vanilla" are adulterated.

Of 32 samples of vanilla extract analyzed 21 were adulterated by the use of color or were entirely fraudulent preparations of coumarin. [See analytical report page 196.]

VINEGAR.

It has many times been asserted by those engaged in enforcing pure food laws that vinegars are subject to adulteration to an extent perhaps greater than is the case with any other article of food.

Analyses of samples of vinegar collected from dealers in Manchester, Nashua, Concord, Portsmouth and Dover offer good evidence, that, in this state, at least, the statement is not overdrawn.

Sixty-eight samples of cider vinegar were analyzed and 39 were found to be adulterated.

Of adulterated samples nine are artificial and 30 are below the standard required for cider vinegars, in acidity or solids, or both. Of the 58 genuine cider vinegars 26 are above the legal requirements for acid and solids and 32 are below.

The striking fact to be noticed in the summary of results is that nearly 60 per cent. of the vinegars examined were adulterated, a finding which is remarkable in view of the fact that our state is well able to make every gallon of vinegar consumed within it. The home product is displaced by the artificial, acetic acid solution, colored with caramel, to the loss of the farmer or local manufacturer and the defrauding of the consumer who pays cider vinegar prices for a cheap, spurious product, lacking all the peculiar aroma and delicate flavor which has given cider vinegar its reputation.

Another significant thing to be seen is that 55 per cent. of all the cider vinegars were below the standard, or legal requirement, and were, therefore, adulterated. Such a condition points to one of two things: either

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the vinegar had been watered or it was improperly made. The adulteration by dilution with water is so obvious a fraud that no comment is necessary, but to many vinegar makers the statement that their product is adulterated will seem unfounded and impossible.

When the standard of acidity and solids is fixed, all vinegars which do not come up to the standard are adulterated and the manufacturer or dealer in such an article is liable for violation of the pure food laws. The practice of saving the first pressing from apple pomace for cider, and then wetting down the exhausted cheese with water before a second pressing, produces a diluted cider which is low in solids and malic acid and which will never make good vinegar. Imperfect acetification is frequently met with. In such cases the vinegar has not been sufficiently aged or has been kept out of access to air. The oxidation of alcohol to acetic acid can only take place in the presence of a liberal supply of oxyxen, and vinegar makers should not expect that cider put into a cool cellar in unvented barrels will make vinegar.

The quality of a vinegar is sometimes injured by an abnormal fermentation or the development of moulds, or by the presence of vinegar eels (*Anguillula oxophila*). Foreign substances are occasionally accidentally introduced into vinegar which injure its color or render it injurious to health. The common practice of using as a funnel a wooden bucket with a lead tube or of employing a lead spigot leads to the formation of sugar of lead (lead acetate) which is an active poison. [See analytical report, page 197.]

MISCELLANEOUS FOOD PRODUCTS.

Under this head are included all those articles that cannot be readily classified and those products of which but few samples have been analyzed. A number of samples of prepared codfish were analyzed and but one sample was found to be free from borax.

Several brands of mince meat were examined but all were pure with the exception of one sample that was preserved with benzoate of soda.

A sample of preserved desiccated eggs was analyzed and the yolk proved to be full of salicylate of soda. The white of the egg was put in a separate package and was sold in a frozen state. [See analytical report, page 198.]

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FOOD PRODUCTS ADULTERATED OR BELOW STANDARD.

The following lists have been analyzed at the State Laboratory of Hygiene with results as stated. These lists include chiefly such goods as have been found not to meet the requirements of the Public Statutes of New Hampshire.

BOTTLED BEVERAGES.

Lab. No.	Name.	Manufacturer.	Where Collected.	Remarks.
961	Orange Phosphate	F. E. Flanders, Boston	Dover	Colored with coal tar dye.
1125	Cliquot Club Birch	Cliquot Club Co., Millis, Mass.	Concord	Preserved with salicylate of soda.
1126	Belfast Crystal Ginger Ale	S. Birch & Co., Belfast	Concord	Preserved with benzoate of soda.
1128	London Shrub	Hoffman & Co., Boston	Concord	Preserved with salicylate of soda.
1129	Orange Cider	Cal. Orange Cider Co., Ocean Grove, N. J.	Concord	Colored with coal tar dye.
1130	Pure Fruit Syrup, Strawberry	F. P. Adams & Co., Boston	Concord	Preserved with salicylate of soda. [zoate of soda.
1131	Ambrosia Punch	Curtis & Moore, Boston	Concord	Colored with coal tar dye; preserved with ben-
1132	Strawberry Fruit Syrup	Curtis & Moore, Boston	Concord	Colored with coal tar dye; preserved with benzo-
1135	Sarsaparilla Fruit Syrup	Falcon Packing Co., New York	Concord	Preserved with salicylic acid. [ate of soda.
1136	Orangeade	H. L. Bowker Co., Boston	Concord	Colored with coal tar dye.
1137	Perfection Lime Juice	M. L. Hall Co., Boston	Concord	Preserved with salicylic acid; acid as citric, 2.66%.
1138	Bee Brand Jamaica Lime Juice	G. W. Bently Co., Boston	Concord	Preserved with benzoate of soda; acid as citric,
1139	Orangeade, Pan-American	J. Hungerford Smith, Rochester, N. Y.	Concord	Colored with coal tar dye. [4.06%.
1255	Red Grape Juice	San Angelos Valley, Cal., A. Prince, N. Y.,	Nashua	Preserved with benzoate of soda; alcohol, 5.84%.
1257	Grape Juice	Adolph Prince, New York [Agent.	Nashua	Preserved with salicylic acid; alcohol, 7.17%.
1259	Fancy Lime Juice	A. J. Gifford, Haskell & Adams, Boston	Nashua	Preserved with salicylic acid; acid as citric, 2.59%.
1560	Ross' Brand Lime Juice	W. A. Ross & Bro., London	Nashua	Preserved with salicylic acid; acid as citric, 5.88%.
1261	Crown West India Lime Juice	J. P. W. Von Layer	Nashua	Acid as citric, 3.06%.
1262	Kingston Lime Juice		Nashua	Acid as citric, 4.51%.
1263	U. S. Club Ora-Ade	Puritan Carbonating Co.	Nashua	Colored with coal tar dye.

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CANNED FRUITS, JELLIES AND JAMS.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Remarks.
407	Ewaxco Strawberry Jelly	Exley, Watkins & Co., Wheeling, W.Va	Concord	Colored with coal tar dye.
438	Duchess Canned Raspberry	John Boyle Co., Baltimore, Md	Epsom	Colored with coal tar dye.
439	Duchess Canned Strawberries	John Boyle Co., Baltimore, Md	Epsom	Colored with coal tar dye.
507	Crabapple Jelly	A. H. Knights Sons Co., Boston	Concord	Colored with coal tar dye.
510	Raspberry Jelly	Victor Packing Co	Keene	Wholly artificial.
511	Canned Strawberries	Ontario Pres. Co., Middleport, N. Y.	Keene	Colored with coal tar dye.
512	Canned Raspberries	Ontario Pres. Co., Middleport, N. Y.	Keene	Colored with coal tar dye.
513	Chapin's Delight Raspberry Jelly	Herbert Chapin & Co., Boston	Keene	Wholly artificial.
546	Currant Flavor Jellies	Central Preserving Co., Boston	Woodsville	Artificial jelly; so marked.
579	Currant Jelly	Columbia Preserving Co., Boston	Manchester	Colored with coal tar dye; pres. benzoate soda.
580	Pomona Jellies, Grape Flavor	E. T. Cowdrey Co., Boston	Manchester	Coal tar dye; apple stock.
581	Wild Strawberry Jam	N. E. Preserving Co., Boston	Manchester	Coal tar dye.
582	Currant Jelly	Logan & Johnson Co., Boston	Manchester	Coal tar dye.
583	Strawberry Jelly, Shaker Brand	E. D. Pettingill Co., Portland, Me	Manchester	Coal tar dye; benzoate of soda.
611	Fresh Fruit Jelly, Currant	Ayer Preserving Co., Ayer, Mass	Concord	Wholly artificial; colored and preserved.
612	Red Raspberry Preserves	Lutz & Schramm Co., Allegheny, Pa.	Concord	Coal tar dye present; benzoate of soda.
613	Choice Strawberry (comp.)	Ideal Preserving Co., Boston	Concord	Pres. with benzoate of soda; not in formula.
615	Strawberry (comp.)	Haskell, Adams & Co., Boston	Concord	Coal tar dye pres't; benz'te soda; not in form'la.
616	Red Currant Jelly [Strawberry.	E. T. Cowdrey Co., Boston	Concord	Coal tar dye.
617	Suffolk Brand Pure Fruit Preserves,	Silas Pierce & Co., Boston	Concord	Coal tar dye.
618	Duchess Extra Quality Fruit Pres'ves	John Boyle Co., Baltimore, Md	Concord	Benzoate of soda; coal tar dye.
619	Raspberry Jelly	E. T. Cowdrey Co., Boston	Concord	Wholly artificial; apple stock, colored, flavored.
620	Strawberry Jelly	E. T. Cowdrey Co., Boston	Concord	Wholly artificial; apple stock, colored, flavored.
621	Damson Fruit Preserves (comp.)	Central Preserving Co., Boston	Concord	Ben. of soda, coal tar dye; package so marked.
675	Red Currant Jelly	E. T. Cowdrey Co., Boston	Concord	Coal tar dye present.
677	Red Raspberry Preserves	Jos. Campbell Pres. Co., Camden, N.J.	Concord	Largely apple stock colored with coal tar dye.
714	Currant Jelly, Homemade Table Jelly	J. T. Pillman, Ayer, Mass	Newport	Coal tar dye; preserved benzoate of soda.
716	Red Raspberry Preserves	Lutz & Schramm Co., Allegheny, Pa.	Newport	Colored with coal tar dye.
717	Raspberry Preserves, Ft. Henry Br'nd	West Va. Pres. Co., Wheeling, W. Va.	Newport	Benzoate of soda and coal tar dye.
718	Fruit Preserves, White Daisy (comp.)	T. Eward & Co., New York	Newport	As labelled.
724	Red Raspberry, White Daisy Brand	T. Eward & Co., New York	Newport	Colored with coal tar dye.
727	Damson Jam (comp.)	J. T. Pillman, Ayer, Mass	Newport	Colored with coal tar dye.
728	Pitted Cherries, Souvenir Brand	Cobb Preserving Co., Rochester, N.Y.	Newport	Colored with coal tar dye.
729	Tomato Preserves	Lutz & Schramm Co., Allegheny, Pa.	Newport	Benzoate of soda.
763	Damson Plum	J. T. Pillman, Ayer, Mass	Contoocook	Colored with coal tar dye.
764	Winner Brand Jam, Pineapple	No name	Contoocook	Preserved, salicylic acid.
765	Currant Jelly, Quaker Brand (comp.)	John Boyle Co., Baltimore, Md	Contoocook	Colored with coal tar dye.
766	Cherry Jam, Seal Brand	P. J. Ritter Conserve Co., Phila., Pa.	Contoocook	Benzoate of soda.
767	Blackberry Jam, Seal Brand	P. J. Ritter Conserve Co., Phila., Pa.	Contoocook	Benzoate of soda.
776	Cherry Preserves	Lutz & Schramm Co., Allegheny, Pa.	Hanover	Benzoate of soda.
812	Fresh Fruit Lemon Preserves	Interstate Preserving Co., Boston	Manchester	Artificial compound, falsely labelled
813	Raspberry Jam (comp.)	Interstate Preserving Co., Boston	Manchester	Colored with coal tar dye.

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CANNED FRUITS, JELLIES AND JAMS.—*Concluded.*

Lab. No.	Brand.	Manufacturer.	Where Collected.	Remarks.
816	Fruit Jelly, Peach Flavor (comp.)	Haskell, Adams Co., Boston	Manchester	*Colored with coal tar dye.*
817	Raspberry Flavor (comp.)	Middleby Co., Boston	Manchester	Apple stock, coal tar dye, flavored. [preserved.
819	Fresh Fruit Jelly, Raspberry (comp.)	Ayer Preserving Co., Ayer, Mass.	Manchester	Wholly artificial; apple stock, colored and
820	Raspberry Jam, Merrimack Brand	Riverside Preser'g Co., Lowell, Mass.	Manchester	Largely apple stock; colored with aniline dye.
822	Strawberry Jam, Riverside Fruit Pres.	Mansfield, Witham Co., Lowell, Mass.	Manchester	Coal tar dye; largely apple st'k artificially flav.
944	Sweet Violet Raspberry Jam	Mansfield, Witham Co., Lowell, Mass.	Dover	Benzoic and salicylic acid present: colored with
945	Sweet Violet Strawberry Jam	Mansfield, Witham Co., Lowell, Mass.	Dover	Colored with coal tar dye. [coal tar dye.
946	Red Raspberry	P. J. Ritter Conserve Co., Phila., Pa.	Dover	Colored with coal tar dye; preserved with ben-
947	Raspberry	Mansfield, Witham Co., Lowell, Mass.	Dover	Colored with coal tar dye. [soate of soda.
948	Special Brand, Strawberry Preserve.	Special Preserving Co., Lowell, Mass.	Dover	Colored with coal tar dye; preserved with sali- [cylic acid.
949	Golden Rod Jelly, Currant Flavor	Milliken, Tomlinson Co., Portland, Me.	Dover	Colored with coal tar dye; preserved with ben-
950	Highland Brand Straw'y Pres. (comp.)	The Williams Bros., Detroit	Dover	Colored with coal tar dye. [zoate of soda.
951	Golden Rod Preserves, Peach	Milliken, Tomlinson Co., Portland, Me.	Dover	Preserved with benzoate of soda. [zoate of soda.
952	Chapin's Delight, Raspberry (comp.)	Herbert Chapin Co., Boston	Dover	Colored with coal tar dye; preserved with ben-
954	Choice Lemon	The Ayer Preserving Co., Ayer, Mass.	Dover	Colored with coal tar dye; preserved with ben-
955	Manhattan Club, Currant Flavor	J. H. Folkins Co., Boston	Dover	Colored with coal tar dye. [zoate of soda.
1143	Strawberry Fruit	F. L. Miller Co., Boston	Concord	Colored with coal tar dye. [zoate of soda.
1235	Superior Fruit Jam, Raspberry (comp.)	W. S. Moore, Boston	Nashua	Colored with coal tar dye; preserved with ben-
1237	Bacon Brand Jelly, Strawberry Flav.	W. C. Moore Co., Boston	Boston	Colored with coal tar dye.
1239	Red Current Jelly	Curtice Bros. Co., Rochester, N. Y.	Nashua	Preserved with benzoate of soda.
1240	Old Virginia Fruit Jam, Cherry	G. K. McMeechen & Sons Co., Wheel- [ing, W. Va.	Nashua	Colored with coal tar dye.
1242	Raspberry Jelly	Grocers' Preserving Co., Boston	Nashua	Colored with coal tar dye.
1248	Currant Jelly	Columbia Preserving Co., Boston	Nashua	Colored with coal tar dye.

CHOCOLATE AND COCOA.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Remarks.
397	Plasmon Cocoa	Plasmon Co. of America, N. Y.	Concord	Adulterated, cocoa husks.
398	London Breakfast Cocoa	N. E. Chocolate Co., Winthrop, Mass.	Concord	Adulterated, cocoa husks.
931	Alkethrepta Chocolate	Smith Mfg. Co., New York	Dover	Contains foreign starch, adulterated.
933	Breakfast Cocoa	J. H. Folkins & Co., Boston	Dover	Adulterated, small amount of cornstarch.

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CONDENSED MILK.

These samples are all pure; results are here given for purposes of comparison.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Per cent. Ash.	Per cent. Fat.	Times condensed.	Per cent. Original Fat.
94	Frost Cream	The Cold Process Co., Contoocook, N. H.	Concord		18.75		
387	Pine Tree	Borden's Condensed Milk Co., New York	Concord	1.53	9.00		
389	Red Clover	Scranton Dairy Co., Scranton, Pa.	Concord	1.35	10.08		
390	Eagle	Borden's Condensed Milk Co., New York	Concord		9.00		
491	Challenge	Borden's Condensed Milk Co., New York	Keene		9.54		
492	Empire State	United States Condensed Milk Co., Deansboro, N. Y.	Keene		10.08		
493	Tip Top	Anglo-Swiss Condensed Milk Co., New York	Keene		10.80		
943	Peerless	Borden's Condensed Milk Co., New York	Dover		7.00		
1190	Anchor	American Condensed Milk Co., Jackson, Mich.	Nashua	2.00	9.00	2.71	3.32
1191	White Pansy	American Condensed Milk Co., Jackson, Mich.	Nashua	1.75	10.20	2.50	4.08
1192	Hero	Vermont Condensed Milk Co., Richmond, Vt.	Nashua	1.69	9.90	2.42	4.10
1193	Up-to-date	Huron Condensed Milk Co., Ubly, Mich.	Nashua	1.95	10.80	2.78	3.83
1194	Highland Brand Evap. Cream	Helvetia Condensed Milk Co., Highland, Ill.	Nashua	1.21	10.50	1.78	6.08
1195	Wingold	Huron Condensed Milk Co., Ubly, Mich.	Nashua	1.98	13.20	2.88	4.66
1267	Baby Brand	Borden's Condensed Milk Co., New York	Nashua	1.69	11.40	2.41	4.73
1268	Cloverdale	Cloverdale Creamery Co., Boston.	Concord	1.83	8.10	2.62	3.10

HONEY.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Polarization. Direct.	Polarization. Invert.	Remarks.
589	White Clov'r H'n'y Comp.	F. Whitcher, Marshfield, Vt.	Manchester	+153.2	+148.5	Made from glucose.
633	Orange Blossom Honey	Ayer Preserving Co., Ayer, Mass.	Concord	+36.40	+31.35	Made from glucose.
634	Wild Rose	San Diego Honey Co., San Francisco, Cal. [R. I.	Concord	+6.40	0.0	Adulterated with cane sugar.
747	Cal. Strained Honey	Huntington Maple Syrup & Sugar Co., Providence,	Newport	+14.40	+7.70	Adulterated with glucose.
784	Extracted Honey	Ayer Preserving Co., Ayer, Mass.	Manchester	+140.0	+120.4	Made from glucose.
785	White Clov'r H'n'y Comp.	No name.	Manchester	+121.6	+106.4	Largely glucose.
786	Pure California Honey	No name.	Manchester	+21.6	−23.8	34.13 per cent. cane sugar.
788	Comp. Syrup and Honey.	No name.	Manchester	+155.0	+135.6	Very little honey.
859	Wild Rose	San Diego Honey Co., San Francisco, Cal.	Concord	+6.40	+0.0	Adulterated with cane sugar.
860	Orange Blossom	Ayer Preserving Co., Ayer, Mass.	Concord	+36.40	+31.35	Adulterated with glucose.
925	Orange Blossom	Ayer Preserving Co., Ayer, Mass.	Dover	+36.50	+33.99	Adul. 20 per cent. with glucose.

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LEMON EXTRACTS.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Lemon Oil.	Alcohol.	Remarks.
404	French's Lemon	The R. T. French Co., Rochester N. Y.	Concord	0.0%	35.18%	Contain no lemon oil.
414	Perfect	Williams, Carleton & Co., Hartford, Ct.	Concord	4.4%	89.95%	Below standard.
415	Lemon Extract	Bastine & Co., New York	Concord	2.8%	84.46%	Below standard.
500	Lemon Extract	Wightman & Co., Boston, Mass.	Keene	2.2%	70.41%	Below standard.
501	Lemon Extract	McHenry & Co	Keene	2.4%	69.65%	Below standard.
504	Forest City	Forest City Ext. Co., Portland, Me.	Keene	0.4%	28.51%	Very little lemon oil.
545	Lemon Extract	Saratoga Ext. Co., Saratoga Springs.	Woodsville	0.90%	63.60%	Very little lemon oil.
573	O. K. Lemon	C. L. Cotton Co., Earlville, N. Y.	Manchester	0.0%	34.58%	Wholly artificial.
575	Globe Mills Extract Lemon	No name	Manchester	2.1%	72.28%	Below standard.
576	Lemon Extract	Trumbull & Co., Hartford, Conn.	Manchester	0.0%	50.57%	Wholly artificial.
577	High Grade	Hall Extract Co., Portland, Me.	Manchester	0.9%	61.84%	Below standard.
578	Standard Quality	H. Pariseau & Co., Manchester	Manchester	0.44%	59.03%	Colored with di-nitro cresol.
608	Lemon Extract	Saratoga Extract and Chemical Co., Saratoga Springs, N. Y.	Manchester	1.56%	71.58%	Below standard.
639	Extract Lemon	St. John Co., New York	Concord	0.0%	35.12%	Coal tar dye; wholly artificial.
641	Concentrated Extract Lemon	Kidder & Co., Boston	Concord	1.4%	69.03%	Below standard.
657	Extract Lemon	Williams & Carleton Co., Hartford, Ct.	Concord	4.40%	89.70%	Below standard.
711	Lemon Extract	Burlington Extract Co., Burlington, Vt.	Concord	0.0%	41.55%	Coal tar dye; wholly artificial. [low standard.
744	Extract Lemon	Bell Preserving Co., Boston	Newport	1.50%	77.19%	Colored with coal tar dye; be-
790	O. K. Compound Lemon Flav'g	C. L. Cotton & Co., Earlsville, N. Y.	Manchester	0.0%	86.16%	Wholly artificial.
791	Essence Lemon	Daniels, Cornell Co., Worcester, Mass.	Manchester	0.0%	59.67%	Wholly artificial.
792	Concentrated Extract Lemon	J. H. Folkins & Co., Boston	Manchester	1.35%	76.20%	Below standard.
794	Extract Lemon	Lyons, Delaney Co., Pawtucket, R. I.	Manchester	2.94%	78.43%	Below standard. [orange.
795	Conc. Fruit Extract Lemon	George A. Moss, New York	Manchester	0.0%	24.0%	Artificial; colored with methyl [wholly artificial.
796	Victoria XXX Pure Lemon	No name	Manchester	0.0%	16.72%	Colored with methyl orange;
797	Pure Essence Lemon	A. J. Precourt, Manchester	Manchester	4.56%	93.09%	Below standard.
845	Lemon Extract	Upton & Co., Rochester, N. Y.	Concord	0.0%	35.44%	Wholly artificial.
893	Lemon Extract	N. Y. Extract Co., New York	Dover	0.06%	62.17%	Artificial. [methyl orange.
895	Extract Lemon		Dover	0.0%	16.88%	Wholly artificial. Col'd with [di-nitro cresol.
1203	Vionana	Vionana Specialty Co., Boston	Nashua	8.00%	93.23%	Below standard. Colored with
1204	Lemon Extract	C. L. Cotton, Earlville, N. Y.	Nashua	0.0%	51.10%	Wholly artificial; coal tar dye.
1205	O. K. Lemon	New York Extract Co., Earlville, N. Y.	Nashua	0.0%	29.98%	Wholly artificial; coal tar dye.
1206	Extract Lemon	Danvers Extract Co., Danvers, Mass.	Nashua	8.94%	91.71%	Coal tar dye, otherwise pure.
1207	Standard Lemon	S. W. Harrison & Co., Providence, R.I.	Nashua	0.0%	43.56%	Wholly artificial.
1208	Pure Extract Lemon	L. N. Lussier & Son, Nashua	Nashua	1.87%	78.36%	Below standard.
1310	Concentrated Lemon	California Ext. Co., New York	Hillsborough Bridge.	1.91%	74.25%	Low grade. Col'd coal tar dye.

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MAPLE SYRUP.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Polarization. Direct.	Polarization. Invert.	Remarks.
584	Maple Syrup	Maple Grove Sugar Co., Manchester	Manchester..	+63.50	−21.04	Made from cane sugar.
585	Sap Syrup	F. Whitcher, Marshfield, Vt.	Manchester..	+36.6	−20.13	Dilute syrup, largely cane sug.
586	Maple Syrup.....[Brand	Haskell, Adams & Co., Boston.....[dence, R. I.	Manchester..	+42.00	−17.05	Dilute syrup, 44.9% sucrose.
587	Maple Syrup, Gold Leaf	Huntington Maple Syrup and Sugar Co., Provi-	Manchester..	+38.6	−18.48	Dilute syrup, 43.41% sucrose.
669	Maple Syrup	J. T. Pillman & Co., Ayer, Mass.	Concord	+57.40	−22.28	Largely cane sugar.
670	Maple Syrup	Falcon Packing Co., New York	Concord	+63.60	−22.11	Largely cane sugar.
740	Vermont Maple Syrup	Ayer Preserving Co., Ayer, Mass.	Newport	+68.30	−22.66	Largely cane sugar.
741	Maple Syrup	J. T. Pillman & Co., Ayer, Mass.	Newport	+65.20	−21.56	Largely cane sugar.
809	Vermont Maple Syrup	Maple Grove Sugar Co., Manchester	Manchester..	+63.50	−17.40	Largely cane sugar.
810	Maple Syrup	Geo. Mailhot, Manchester	Manchester..	+81.30	+11.40	Cane sugar and glucose.
811	Vt. Table Syrup (Comp.)	Eagle Extract Co., Boston	Manchester..	+91.90	+70.4	As represented. [glucose.
832	Cream Maple Sugar	Fournier & Schiller Co., Central Falls, R. I.	Manchester..	+102.60	+20.0	Made from sugar cane and
926	Maple Sugar Cream	Riverside Preserving Co., Lowell, Mass.	Dover	+74.00	−22.00	Adulterated with brown sugar.
927	Spindle City	Mansfield, Witham Co., Lowell, Mass.	Dover	+63.50	−21.67	Adulterated with cane sugar.*
973	Maple Syrup	Not known	Concord	+49.80	−20.46	Adulterated with cane sugar.†
975	Maple Syrup	Not known	Concord	+63.20	−21.45	Adulterated with cane sugar.‡
976	Maple Syrup	Not known	Concord	+45.70	−22.66	Very low grade.
1308	Champion Brand	C. A. Reed, Medford, Mass.	Concord	+60.20	−20.85	Adulterated with cane sugar.§

* Ash, 0.20 per cent.; † Ash, 0.14 per cent.; ‡ Ash, 0.80 per cent.; § Ash, 0.14 per cent.;

MOLASSES.

Lab. No.	Brand.	Wholesaler.	Where Collected.	Polarization. Direct.	Polarization. Invert.	Remarks. Per cent.
28	Dark Porto Rico		Concord			28.57 glucose.
29	Light Porto Rico		Concord			27.78 glucose.
30	Light Porto Rico		Concord			11.11 glucose.
928	50 cent	Milliken, Tomlinson Co., Portland, Me.	Dover	+64.80	+23.32	31.4 cane sugar,; 19.10 glucose. adult.
929	40 cent..	Milliken, Tomlinson Co., Portland, Me.	Dover	+78.20	+38.66	30.9 cane sugar; 24.5 glucose, adult.
1086		S. Pierce & Co., Boston	Portsmouth..	+88.00	+60.28	13.53 cane sugar; 42.55 glucose, adult.
1092		Milliken, Tomlinson Co., Portland, Me.	Portsmouth..	+72.40	+34.54	28.90 cane sugar; 24.86 glucose, adult.
1102		Briggs, Seaver & Co., Boston	Portsmouth..	+87.80	+64.42	17.84 cane sugar; 40.00 glucose, adult.
1103		S. Pierce & Co., Boston	Portsmouth..	+84.60	+64.42	15.40 cane sugar; 39.54 glucose, adult.
1105		Wood, Pollard & Co., Boston	Portsmouth..	+57.40	+22.44	26.68 cane sugar; 17.56 glucose, adult.
1106		Milliken, Tomlinson Co., Portland, Me.	Portsmouth..	+67.80	+25.96	31.93 cane sugar; 20.50 glucose, adult.
1110		Milliken, Tomlinson Co., Portland, Me.	Portsmouth..	+49.20	+11.44	28.82 cane sugar; 11.65 glucose, adult.
1171	40 cent	F. M. Bill, Boston	Nashua	+94.00	+67.76	19.72 cane sugar; 42.43 glucose, adult.
1173	50 cent	Holbrook Grocery Co., Nashua	Nashua	+78.20	+51.48	20.09 cane sugar; 33.21 glucose, adult.
1175	45 cent	Holbrook Grocery Co., Nashua	Nashua	+63.00	+29.04	25.53 cane sugar; 15.70 glucose, adult.
1178			Nashua	+78.20	+53.68	18.43 cane sugar; 34.13 glucose, adult.

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Lab. No.	Brand.	Wholesaler.	Where Collected.	Preservative Found.
286			Concord	Boric acid.
287			Concord	Boric acid.
288			Concord	Boric acid.
289			Concord	Boric acid.
352			Concord	Boric acid.
366			Concord	Boric acid.
367			Concord	Boric acid.
368			Concord	Boric acid.
370			Concord	Boric acid.
371			Concord	Boric acid.
372			Concord	Boric acid.
374			Concord	Boric acid.
430	Norfolk		Dover	Boric acid.
431	Providence River		Dover	Boric acid.
432	Providence River		Dover	Boric acid.
433	Norfolk		Dover	Boric acid.
434	Providence River		Dover	Boric acid.
435	Providence River		Dover	Boric acid.
436	Norfolk		Dover	Boric acid.
441			Concord	Boric acid.
442			Concord	Boric acid.
448			Concord	Boric acid.
449			Concord	Boric acid.
452			Concord	Boric acid.
473	Norfolk		Portsmouth	Boric acid.
474	Large Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
475	Medium Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
476	Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
482		R. R. Higgins & Co., Boston	Manchester	Boric acid.
484		D. Atwood & Co., Boston	Manchester	Boric acid.
486		D. Atwood & Co., Boston	Manchester	Boric acid.
521	Large Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
552	Medium Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
552			Dover	Boric acid.
978	Large Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
979	Small Norfolk	R. R. Higgins & Co., Boston	Portsmouth	Boric acid.
1285		R. R. Higgins & Co., Boston	Manchester	Boric acid.
1288		R. R. Higgins & Co., Boston	Manchester	Boric acid.
1290		Norfolk Oyster Co., Boston	Keene	Boric acid.
1298		W. L. Chase, Norfolk, Va.	Keene	Boric acid.
1316		Boston Oyster Co., Boston	Concord	Boric acid.
1321		Wheeler & Barnes, Boston	Manchester	Boric acid.
1323		Wheeler & Barnes, Boston	Manchester	Boric acid.
1326		E. S. Newton & Co., Manchester	Manchester	Boric acid.
1330		E. S. Newton & Co., Manchester	Manchester	Boric acid.
1333		R. R. Higgins & Co., Boston	Dover	Boric acid.
1334		R. R. Higgins & Co., Boston	Dover	Boric acid.
1338		R. R. Higgins & Co., Boston	Dover	Boric acid.
1340		Wright & Willis, Boston	Raymond	Boric acid.
1341		Boston Oyster Co., Boston	Concord	Boric acid.

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CLAMS.

Lab. No.	Brand.	Wholesaler.	Where Collected.	Preservative Found.
528	.....	R. R. Higgins & Co., Boston.....	Portsmouth....	Boric acid.
1159	.....	J. H. Stubbs, Boston...	Concord.....	Boric acid.
1327	.....	Wheeler & Barnes, Boston.....	Manchester....	Boric acid.

TOMATO KETCHUPS.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Color.	Preservative.
97	Tomato Ketchup.....	Lutz & Schramm Co., Allegheny, Pa.....	Concord.....	Coal tar dye...	Benzoic acid.
316	Climax Homemade.....	C. F. Loudon, Cincinnati, Ohio.	Concord.....	Coal tar dye...	Benzoate of soda.
365	Tomato Ketchup.....	J. S. Burbank & Co., South Hooksett.....	Concord.....	Coal tar dye...	Salicylic acid.
437	Ideal Ketchup.....	N. E. Packing Co., Boston.....	Epsom	Coal tar dye...	Benzoic acid.
591	Pride of Rhode Island.....	American Pickling Co., Providence, R. I....	Manchester..	Coal tar dye...	Benzoate of soda.
592	Our Favorite.....	Farnham Canning Co., Farnham, N. Y.....	Manchester..	None.....	Benzoate of soda.
660	Van Camp's.....	Van Camp Packing Co., Indianapolis, Ind..	Concord.....	None.....	Benzoate of soda.
661	Shaker.....	E. D. Pettingill & Co., Portland, Me.....	Concord.....	Coal tar dye...	Benzoate of soda.
663	Surprise.....	Crescent Preserving Co., Camden, N. J.....	Concord.....	Coal tar dye...	Benzoate of soda.
746	Daisy...	F. E. Warden, New York.....	Newport.....	Coal tar dye...	Benzoate of soda.
827	Spindle City.....	Mansfield, Witham & Co., Lowell, Mass....	Manchester..	Coal tar dye...	Benzoate of soda.
910	Imperial Relish.....	Sawyer Crystal Blue Co., Boston.....	Dover.....	Coal tar dye...	Salicylic acid.
911	Shaker Sweet Tomato Pickle	E. D. Pettingill, Portland..... ...	Dover.....	Coal tar dye...	Salicylic and benzoate soda.
912	Le Roy.....	Le Roy Packing Co., Boston.....	Dover.....	Coal tar dye...	Benzoate soda.
915	Violet.....	J. W. Sharpe Canning Co., Williamst'n, N.J.	Dover.....	Coal tar dye...	Benzoate soda.
916	Honey Dew.....	Erie Preserving Co., Buffalo.....	Dover.....	Coal tar dye...	Benzoate soda.
987	Sunny Side.....	Tip Top Ketchup Co., Cincinnati, Ohio.....	Portsmouth..	Coal tar dye...	Benzoate soda.
988	Metropolitan.....	J. H. Folkins & Co. Boston..... ..	Portsmouth..	Coal tar dye...	Benzoate soda.
989	Home Made.....	The T. A. Snyder Preserve Co., Cincinnati, O.	Portsmouth..	Coal tar dye...	Benzoate soda.
990	Blue Label.....	Curtice Bros. Co., Rochester, N. Y.....	Portsmouth..	None	Benzoate soda.
991	Tomato Ketchup.....	Cruikshank Bros., Allegheny, Pa.....	Portsmouth..	Coal tar dye...	Benzoate soda.
992	Diamond.....	Lutz & Schramm Co., Allegheny, Pa.....	Portsmouth..	Coal tar dye...	None.
993	Burbanks.....	J. S. Burbank, Manchester, N. H.....	Portsmouth..	Coal tar dye...	Salicylic acid.
994	Our Favorite.....	Farnham Canning Co., Farnham, N. Y.....	Portsmouth..	Coal tar dye...	Benzoate soda.
995	Columbia.....	The Mullen-Blackledge Co., Indian'lis, Ind.	Portsmouth..	Coal tar dye...	Benzoate soda.
996	Campbell's.....	Jos. Campbell Preserving Co., Camden, N.J.	Portsmouth..	Coal tar dye...	Benzoate soda.
997	Le Roy.....	Le Roy Packing Co., Boston.....	Portsmouth..	Coal tar dye...	Benzoate soda.
1024	Tomato Ketchup.....	H. J. Heinz. Pittsburg, Pa.....	.....	None	Benzoate soda.
1073	Catsup.....	Van Camp Packing Co., Indianapolis, Ind..	Portsmouth..	Coal tar dye...	Benzoate soda.
1231	Health Brand.....	J. P. & D. Plummer, Boston .....[W. Va.	Nashua.....	Coal tar dye...	Benzoate soda.
1232	Old Virginia Tom'to Bouillon	G. K. McMeechen & Sons Co., Wheeling,	Nashua.....	None	Benzoate soda.
1269	Fort Henry Chili Sauce.....	West Virginia Pres. Co., Wheeling, W. Va.	Nashua.....	Coal tar dye...	Benzoate soda.

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VANILLA EXTRACTS.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Vanillin.	Coumarin.	Remarks.
742	Genuine Extract Vanilla	R. T. French Co., Rochester, N. Y.	Newport	.0884	Much	Colored with caramel.
743	Vanillette Extract	Henry Horner & Co., Chicago	Newport	.000	Much	Colored with caramel.
799	Compound Extract of Vanilla	J. H. Folkins & Co., Boston	Manchester	.....	Much	Colored with caramel. [car.
801	Gem Fruit Extract Vanilla	G. A. Moss, New York	Manchester	.125	.....	Van'lin is synthetic. Col. with
844	Vanilla Extract	Upton & Co., Rochester, N. Y.	Concord	.137	Present	Vanillin is synthetic. Color is Bismark brown.
897	Concentrated Extract Vanilla	N. Y. Extract Co., New York	Dover	.075	None	Vanillin artificial, adulter'ed.
899	Extract Vanilla	.....	Dover	0.0	Much	Colored with car.; fraudulent.
900	Acme Brand Vanilla	Acme Extract Co., Binghamton, N. Y.	Dover	0.0	Much	Colored with car.; fraudulent.
901	Extract Vanilla	J. H. Folkins & Co., Chelsea	Dover	0.0	Much	Colored with car.; fraudulent.
902	Vanilla	F. A. Barker, Gloucester, Mass.	Dover	.0875	Present	Adulterated with coumarin.
903	French's Extract Vanilla	R. T. French, Rochester, N. Y.	Dover	.025	Much	Col. with car.; adulterated.
1211	Vionana Conc. White Vanilla	Vionana Specialty Co., Boston	Nashua	0.275	None	Entirely artificial.
1212	Superior Extract Vanilla	C. L. Cotton, Earlville, N. Y.	Nashua	0.0875	None	Weak extract. [artificial.
1213	Royal Palm	Franklin Extract Co., New York	Nashua	0.112	Present	Colored with car.; vanillin
1214	Premium	Francis Leggett & Co., New York	Nashua	0.05	Present	Col. with car.; wholly artifi'l.
1215	Good Value	——, Binghamton, N. Y.	Nashua	0.025	Present	Wholly artificial. [ly artific'l.
1216	Extract Vanilla	Danvers Extract Co., Danvers, Mass.	Nashua	0.125	None	Col. with coal tar dye; whol-
1217	Forest City	Forest City Extract Co., Portland, Me.	Nashua	0.0	Present	Colored; artificial.
1273	Crescent Ext. Vanilla and Tonka	Crofts & Reed, Chicago	Concord	.100	Present	Colored with caramel.
1274	Pure Concentrated Extract	Crofts & Reed, Chicago	Concord	.075	None	Colored with caramel.
1275	Concentrated Extract	Grand Union Tea Co., Brooklyn	Concord	.025	Present	Colored with caramel.

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CIDER VINEGAR.

Lab. No.	Acidity as Acetic Acid. Per cent.	Solids. Per cent.	Ash. Per cent.	Polarization.	Precipitate with Lead Acetate.	Remarks.
804	5.27	1.64	.260	−1.4	Heavy	Below standard.
805	4.89	2.30	.297	±0.0	Heavy	Below standard.
806	4.24	.64	.....	+2.0	None	Artificial.
807	4.37	.64	.....	+1.0	None	Artificial.
808	4.19	.64	.....	+2.6	None	Artificial.
846	1.93	2.09	.314	−1.0	Heavy	Below standard.
848	4.19	.....	.....	−1.5	Heavy	Below standard.
882	4.39	.55	.111	+2.8	Slight	Artificial.
904	3.24	.....	.....	+1.4	None	Artificial.
906	4.16	.....	.....	±0.0	Heavy	Below standard.
907	4.46	.....	.....	−0.4	Heavy	Below standard.
1045	2.77	1.32	.199	−0.4	Heavy	Below standard.
1046	3.16	1.74	.184	−1.6	Slight	Below standard.
1047	1.74	3.83	.137	−3.5	Heavy	Below standard.
1049	3.49	1.77	.104	−1.7	Heavy	Below standard.
1052	3.16	1.29	.397	+2.0	None	Artificial.
1054	2.97	.89	.078	+1.0	None	Artificial.
1055	4.58	.91	.097	+0.6	None	Artificial.
1057	6.00	1.58	.357	−0.4	Slight	Below standard.
1060	2.85	1.83	.420	−0.8	Heavy	Below standard.
1061	2.97	1.80	.200	−0.4	Heavy	Below standard.
1063	3.86	2.13	.202	−0.7	Heavy	Below standard.
1066	2.39	.86	.088	±0.0	None	Artificial.
1070	3.18	3.32	.330	−2.6	Heavy	Below standard.
1182	5.08	1.39	.269	.....	Heavy	Below standard.
1184	3.21	5.11	.237	.....	Heavy	Below standard.
1186	4.39	3.09	.108	.....	Heavy	Below standard.
1188	2.78	3.62	.256	.....	Heavy	Below standard.
1189	4.39	2.43	.135	.....	Heavy	Slightly below standard.
1295	6.48	1.53	.400	−1.00	Heavy	Solids low.
1296	4.34	2.06	.300	−1.80	Heavy	Acidity low.
1297	3.73	1.71	.380	−0.80	Heavy	Below standard.
1298	4.42	2.18	.320	−1.30	Moderate	Acidity low.
1299	3.05	1.32	.260	−0.40	Heavy	Below standard.
1300	4.46	2.07	.280	−1.40	Heavy	Acidity very slightly low.
1301	4.30	1.56	.330	−1.70	Heavy	Below standard.
1302	4.15	5.70	.410	+19.60	Heavy	Artificial.
1304	2.89	2.08	.260	−0.00	Heavy	Below standard.
1305	3.82	1.69	.280	−0.60	Heavy	Below standard.

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MISCELLANEOUS FOOD PRODUCTS.

Lab. No.	Brand.	Manufacturer.	Where Collected.	Remarks.
47	Butter		West Derry..	Analysis showed sample to be oleomargarine.
50	Preserved Eggs		Concord.. ...	Whites frozen; yolks pres. with salicylic acid.
82	Lard		Concord.....	Contains beef stearine.
153	Pure Canada Malt Extract	Martin L. Hall, Boston	Warren.....	Contains 4.45% alcohol.
381	Sausage Binder		Concord.....	Contains 1.29% boric acid.
412	Shredded Codfish	J. W. Beardsley's Sons Co., New York	Concord.....	Preserved with boric acid.
596	Codfish	Slade, Gorton & Co., Gloucester, Mass	Manchester..	Preserved with boric acid.
643	Azalea Brand, Codfish	Potter & Wrightington, Boston	Concord.....	Preserved with boric acid.
698	Mince-meat	Joseph Campbell, Camden, N. J.	Concord.....	Preserved with benzoate of soda.
707	Tripe	Hammond Provision Co., Boston	Concord.....	Preserved with boric acid.
748	Lime Juice	J. T. Pillman & Co., Ayer, Mass.	Newport.....	Preserved with salicylate of soda.
885	Eiderdown Codfish	Schute & Merchant, Gloucester, Mass.	Dover.....	Preserved with borax.
1140	Ice Cream	Concord Candy Market, Concord	Concord.....	Fat 14%; gelatin present.
1141	Ice Cream	Concord Candy Kitchen, Concord	Concord.....	Fat 13%; gelatin present.
1248	Frankfurtur Sausage		Nashua.....	Preserved with borax.
1249	Snow Brand Codfish	B. S. Snow & Co., Boston	Nashua... ...	Preserved with borax.
772	Blood Sausage	Boston Packing Co., Boston	Concord.....	Preserved with boric acid.
889	Huile d'Olive	E. Loubon, Nice	Manchester..	Cottonseed oil.
890	Royal Cheese	Gourlay, Thompson Co., Detroit, Mich	Dover.....	Preserved with borax.
558	Sausage	Boston Packing and Prov. Co., Boston	Concord.....	Adulterated with boric acid; colored.
880	Gold Medal Mustard		Manchester..	Adul. with wheat flour and must'd hulls; color'd
80	Café des Invalids (comp.)	S. S. Pierce & Co., Boston	Concord.....	Not as represented. [with tumeric.
104	Haines' Improved Danlion Coffee	Wm. B. Hunt & Co., Boston	Concord.....	Coffee, roasted peas, etc.
384	Cal. Golden Brand Coffee (compound)	Golden Brand Hygienic Coffee Co., Los Angeles, Cal	Concord.....	Wheat, peas, etc.; no coffee.
385	New Era Hygienic Coffee (compound)	E. C. Rich, New York	Concord.....	Roasted wheat; no coffee.
681	Haricot Flageolets	H. Felix & Co., Bordeaux.....[Mich.	Concord.....	Colored with copper; .030 grams per can.
682	Waldorf Baked Beans	Williams Bros. & Charbonneau, Det't,	Concord.....	Preserved with benzoate of soda.
687	Golden Piccalilli	Skilton, Foote & Co., Boston	Concord.....	Preserved with benzoate of soda.
781	Vienna Sausage	Libby, McNeil & Libby, Chicago	Newport.....	Preserved with boric acid.
1309	Sausage	J. P. Squires, Boston	Concord.....	Borax present.

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SUMMARY OF RESULTS.

ARTICLES EXAMINED.	Number found to be of good quality.	Number adulterated or varying from the legal standard.	Total articles examined.	Percentage of adulteration.
Bottled beverages	13	23	36	63.9
Butter	1	1	2	50.0
Canned fruits, jellies and jams	37	66	103	64.1
Canned goods, miscellaneous products	38	8	46	17.4
Cheese	3	3	6	50.0
Clams	10	3	13	23.1
Coffee, cocoa and chocolate	25	6	31	19.3
Condensed milk	15	1	16	6.2
Cream of tartar and baking powder	9	2	11	18.2
Honey	21	11	32	34.4
Lard	2	3	5	60.0
Lemon extract	19	34	53	64.1
Maple syrup	20	16	36	44.4
Milk	260	111	371	30.0
Molasses	35	16	51	31.4
Olive oil	6	2	8	25.0
Oysters	73	50	123	40.6
Sausage	1	12	13	92.3
Spices	40	5	45	11.1
Tomato ketchup	5	36	41	87.8
Vanilla extract	11	21	32	68.7
Vinegar,—cider	29	39	68	57.3
Miscellaneous food products	106	44	150	29.3
Totals	779	513	1,292	39.7

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ANALYSES OF GLUTEN FLOURS, USED IN THE TREATMENT OF DIABETES.

BY H. E. BARNARD, CHEMIST.

Diabetes is a disease having to do with some disturbance of the carbohydrate metabolism which results in a non-assimilation of sugars. Von Woorden says: "The essential disturbance in diabetes consists in the fact that the organism is not in the condition to burn its carbohydrates. The carbohydrates of the food, and in some cases the carbohydrates which originate in the body itself, from albumen or fat, flow off through the urine in the form of glucose, or grape sugar."

A most important point in the treatment of the disease is the more or less complete elimination of sugar and starch from the diet, and as a natural corollary it follows that the ingestion of these substances, except in small amounts, is often equivalent to the administration of a poison. The natural craving for sweets can, in a measure, be satisfied by substituting for sugar, glycerine or saccharin, but a satisfactory substitute for starch has been more difficult to obtain.

The force of the phrase "staff of life," as applied to bread, is appreciated when the attempt is made to exclude it permanently from the diet. The diabetic patient craves bread, although it is most injurious because of the amount of starch it contains,—nearly 80 per cent. of its solid constituents. The effort has often been made to replace it with other foods containing little or no starch. Camplin, a medical practitioner of London, employed bran cakes as a substitute for bread. This bread, however, contains a large amount of starch, and is moreover very unpalatable and difficult of digestion.

Dr. Pavy of London recommends rusks, or biscuits made from finely ground almonds. And recently Mosse* has advised the use of baked potatoes. It is difficult to see how their use can have much advantage over the use of bread, as potatoes contain a very large amount of starch, readily convertible into sugars.

Kuelz † has had biscuits made of inulin, a starch which he asserts has no effect on the excretion of sugar by diabetics.

* Revue de Med., 1902.
† Beetr., i., page 145.

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All these substitutes have largely failed their purpose, and gluten flour, invented in 1841 by Bouchardet, and improved by other experimenters, has been adopted as the only material practicable for making a bread low in starch. German and French manufacturers have succeeded in producing a gluten flour suitable for bread-making which contains little starch. The same is true of English glutens as shown by the analyses made by Fielding of British glutens of commerce, who found in the samples from 60 to 76 per cent. of gluten, and but 7.6 to 16.7 per cent. of starch.*

Manufacturers of starch from wheat have endeavored to employ the glutinous matter left after the extraction of starch. This glutinous residue is ground and added to ordinary flour in different proportions for the purpose of increasing the percentage of nitrogen and diminishing that of the carbohydrates.

Woods,† Jaffa,‡ Atwater and Bryant,§ Sherman and Burr‖ and Harrington¶ have analyzed many of the American gluten flours and prepared foods and arrive at the conclusion that American diabetic flours are, for the most part, inferior goods, containing much greater quantities of starch than they purport to, and that they are unsuitable as foods for diabetics.

This laboratory has been called upon frequently to examine diabetic flours for the purpose of determining the amount of starch present and our results have shown that they differ but little from ordinary flour in composition. In other words, the extravagant claims made by the manufacturers of the virtue of their products were not substantiated by our analyses.

The lack of definite data concerning diabetic foods has prompted us to undertake a more extended investigation of their character than has heretofore been made. Samples of all the diabetic and gluten flours obtainable were gathered, together with one sample of Soja Bean meal, a substitute for flour and therefore included in the class of diabetic foods, and samples of whole wheat, or graham flours, and spring wheat patent flour. Complete analyses were made of each sample, so far as practicable, and include a determination of moisture, fat, proteids, ash, crude fiber, soluble carbohydrates, starch, gluten and acidity. The methods outlined in Bull. 46, U. S. Dept. of Agri. were employed when possible. Gluten was determined roughly after the method employed by

* Phar. Jour., iv, 7, 170.
† Rep. Me. Ex. Sta. 1899, pp. 97, 104.
‡ Bull. 84, Office of Ex. Sta. U. S. Dept. of Agri.
§ Bull. 28, revised. Office of Ex. Sta. U. S. Dept. of Agri.
‖ N. Y. Med. Jour. Oct. 12, 1901.
¶ Bos. Med. & Surg. Jour. vol. cxviii, 12, p. 287.

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Trescott in his analyses of the cereals collected at the World's Columbian Exposition, and reported in Bull. 45, U. S. Dept. of Agri. The carbohydrates were estimated by difference in order that the results might accord with the work of other investigators, but direct determinations of the starch were also made which probably express more accurately the true starch content of the flours.

In the estimation of the proteids the factor 6.25 times nitrogen was employed. This factor is not a true constant and varies considerably for different flours. In flours high in gluten the resulting proteid content may, therefore, fail to represent the true amount present, thus introducing a large error if the starch is determined by difference. The unreliability of this proteid factor makes it impossible to obtain totals of 100 per cent., a matter, however, of little moment in the discussion of the work at hand, which is comparative in its nature. The soluble carbohydrates, which includes reducing sugars, small quantities of sucrose, etc., were estimated by inversion and precipitation by Fehling's Solution.

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Number.	Moisture.	Ash.	Proteids.	†Soluble carbohydrates.	Starch.	Fat. Ether extract.	Crude fibre.	Acidity as lactic acid.	Total.	Dry gluten.	Total carbohydrates.	Carbohydrates by difference.
1	12.66	.42	10.60	2.27	72.33	.68	.29	.22	99.47	8.13	74.60	75.13
2	12.68	.69	9.02	3.19	67.86	1.28	1.28	.47	96.47	9.83	71.05	74.58
3	12.52	.41	11.38	2.92	72.33	.77	.54	.29	101.16	11.70	75.25	74.09
4	12.68	1.46	11.63	4.10	68.36	2.47	1.81	1.04	97.55	8.81	67.46	69.91
5	12.47	.92	11.52	1.72	68.45	1.94	.86	.29	98.17	10.47	70.17	72.00
6	9.43	.51	83.44	1.60	47.62	2.00	1.17	.55	96.32	28.66	49.22	52.90
7	7.62	.58	75.44	*	7.81	1.33	.75	.79	94.32	§	7.81	13.39
8	9.47	1.58	29.06	4.26	47.92	3.10	1.52	.97	97.90	27.05	52.18	54.23
9	7.45	.48	75.52	*	9.73	1.83	.77	1.15	96.93	§	9.73	12.80
10	8.73	.68	43.82	1.92	39.10	1.77	.80	.54	97.36	40.80	41.02	43.66
11	7.80	.56	51.24	1.42	30.67	1.42	.79	.18	94.08	34.00	32.09	38.01
12	11.15	.38	10.06	1.42	72.33	1.18	2.36	.22	99.12	8.81	73.75	74.68
13	9.28	.91	35.43	12.17	14.74	18.98	4.24	2.75	98.50	§	26.91	28.41
14	.....	.....	.....	.81	51.81	.....	.....	.....	.....	.....	52.62	.....
15	12.33	1.04	16.53	1.93	64.33	2.68	.28	.92	100.04	.....	66.26	66.22
16	10.61	.49	23.10	3.42	57.50	1.43	.....	.81	96.86‡	.....	60.92	.....
17	12.28	.92	13.47	1.66	68.75	1.08	.93	.58	99.62	.....	70.41	70.79
18	9.72	.96	31.76	.91	50.24	2.30	1.10	.85	97.64	.....	51.15	53.31
19	9.81	3.88	34.96	.42	47.82	1.66	.69	.....	99.24	.....	48.24	49.00
20	8.37	.62	76.83	.18	6.81	1.54	.41	1.80	96.53	82.36	6.94	10.43
21	4.27	.88	19.09	2.00	70.00	1.17	.65	.58	98.64	.....	72.00	73.36
22	6.77	.91	42.99	1.34	41.66	2.51	.61	.70	97.49	.....	43.00	45.51
23	5.63	.72	78.11	.83	8.52	2.58	1.60	.95	98.94	.....	9.35	10.41

No. 1. Gluten flour made by Farwell & Rhines and advertised by them as follows: "Gluten Flour. This is a Brain, Nerve, Bone, and Muscle building Flour, especially prepared for the invalid, and particularly for that large class who suffer from weak digestion, acidity of the stomach, constipation, obesity, and Debility. . . . It has also been found a highly important aid in the practice of Scientific Dentistry, strengthening the teeth and promoting the health and growth of the gums. It is entirely without Bran and as nearly free from Starch as it is practicable to make

* Not determined.
† Reducing sugars, sucrose, etc.
‡ Crude fiber not included.
§ Impossible to determine.

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a Flour suited to general daily use. The majority of Diabetics find it just what they need," etc.

Our analysis showed this flour to be practically the same in composition as ordinary fine wheat flour. The percentage of starch present is as great as in wheat flour and the amount of gluten no larger.

No. 2. Whole Wheat K. C. Flour, made by Farwell & Rhines and said to be a genuine whole wheat flour.

The results of our analysis substantiate this statement and are inserted for the purpose of comparison of other brands.

No. 3. Best XXXX Spring Wheat Patent, made by Farwell & Rhines.

An analysis of this sample of fine spring wheat flour is inserted for purposes of comparison.

No. 4. Special Diabetic Food, made by Farwell & Rhines, widely advertised as a food for diabetics. The manufacturers recommend it as follows: "To Diabetics who have heretofore been restricted to almond bread, bran bread, cakes, and other indigestible substitutes, the 'staff of life,' as offered to them in our 'Special Diabetic Flour,' is a vital necessity. It contains all the elements of repair; patients thrive on it; and, above all, do not tire of its use."

An analysis of this flour shows a very slight decrease in the starch content as compared with ordinary flours, while the gluten present is less than in normal flours.

No. 5. Gluten Grits, made by Farwell & Rhines. Recommended as an invaluable food for the dyspeptic, diabetic, and debilitated. This brand is similar in composition to whole wheat flour, and possesses no advantage over that well-known article.

No. 6. Glen Mills Unsurpassed Gluten Flour, sold by the Johnson Educator Food stores and recommended as follows: "This is a flour that may well be sought after by all suffering from Weak Digestion, Obesity, Diabetes, Bright's Disease, Gouty and Rheumatic troubles, as it is a pure vegetable nitrogen."

Instead of being a "pure vegetable nitrogen" the flour contains nearly 50 per cent. of carbohydrates. The nitrogen present in the form of proteids is considerably higher than is usual in ordinary flours.

No. 7. Washed Gluten. Sold by the Johnson Educator Food Stores and guaranteed by the salesman to contain less than two per cent. of starch. This gluten, although not as pure as guaranteed, was very high in proteids and comparatively low in starch. The dealers do not claim this product to be useful for bread-making, but recommend the food to be taken with milk or cream, probably in an uncooked state.

No. 8. Gluten (Glutosac). Made by the Health Food Company. This

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is claimed by the makers to be the germ of the wheat berry stripped of its outside coat, which contains "the greater proportion of the carbohydrate bodies," a statement not in accordance with the usual ideal of the composition of the wheat berry. This product contains almost 50 per cent. of starch and approximately twice as much proteids as common wheat flour.

No. 9. Pure Gluten. Made by the Health Food Company. This product contains a very high percentage of proteids and a correspondingly low starch content. The makers do not advertise this preparation as a practicable material for bread-making, but advise its use, together with almonds, in preparing biscuits with the aid of butter and baking powder.

No. 10. Gum Gluten Ground. Made by the Pure Gluten Food Company. This is claimed to be pure gluten gum obtained, in the process of making wheat starch, as a residue from which all the starch has been washed. It is high in proteids and relatively low in starch. The amount of gluten present is nearly 41 per cent.

No. 11. Gum Gluten Breakfast Food. Made by the Pure Gluten Food Company. This product is advertised as "The extracted proteids from wheat; recognized by scientists as the most valuable food substance within the knowledge of man."

This food contains over 50 per cent. of proteids and about one half the amount of starch usually found in whole wheat flour.

No. 12. Pure Vegetable Gluten. Sold by Theodore Metcalf Company.

This product has the same composition in every particular as ordinary flour, and is no more valuable as a diabetic flour.

No. 13. Soja Bean Meal. Sold by Theodore Metcalf Company.

This meal is rich in proteids, low in starch, and contains a large amount of fat. If it were possible to make a palatable bread from it it would be valuable as a substitute for wheat flour.

No. 14. Gluten Flour. Made by the Sanitarium Food Company and advertised as "Indispensable in cases of diabetes, acid dyspepsia, weak digestion, and nervous debility."

The small sample which we were able to obtain was sufficient only for a starch determination.

No. 15. Diabetic Gluten Flour. Made by Wilson Bros., and advertised by them to contain a very small per cent. of the starchy part of the wheat, and to be a special food for diabetics. This flour is but little higher in proteids and lower in starch than is ordinary whole wheat flour.

No. 16. Gluten Flour. Sold by the Johnson Educator Food Company. The proteid content is about 10 per cent. higher than in whole wheat flour and the starch content correspondingly lower. But this slight

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deviation from the normal composition of flour does not warrant its sale as a gluten flour to persons suffering from diabetes.

No. 17. Entire Wheat Flour. This flour has a proteid content rather higher than that of most whole wheat flour.

No. 18. Gum Gluten Ground. Made by the Pure Gluten Food Company. This flour is supposed to be the same product as No. 10, although differing greatly from it in composition. The proteid content is 12 per cent. lower and the starch content 11 per cent. higher.

No. 19. Gum Gluten Flour, Self Raising. This is very similar in composition to No. 18, except that it contains baking powder.

No. 20. Pure Gluten. Made by the Health Food Company. This is the same flour as No. 9 and varies but little from that sample in composition.

No. 21. Twenty per cent. Gluten. Made by the Battle Creek Sanitarium Company, Limited. This flour contains nearly the advertised quantity of gluten but also contains as much starch as normal flour. The product is very dry and the increase in proteids but counteracts the diminished moisture content.

No. 22. Forty per cent. Gluten. Made by the Battle Creek Sanitarium Company, Limited, and claimed to be "Indispensable in cases of Diabetes, etc." The starch content is greatly lowered and the proteid content increased until the two are very nearly equal.

No. 23. Made by the Battle Creek Sanitarium Company, Limited. This product is very high in proteids and low in carbohydrates. It is not intended for bread making but is to be eaten with cream or fruit juices.

Our results agree with other published analyses in showing that many of the so-called diabetic foods, or gluten flours, are of the same composition as whole wheat, or Graham flour, and carry but little less starch than ordinary white flour. Some of the highly recommended and widely advertised "Diabetic Flours" consist solely of whole wheat flour, and by reckless misstatement and deliberate fraud are sold at enormous prices as a cure for diabetes. The action of these manufacturers becomes not only fraudulent but even criminal when we realize that these goods which are sold to invalids are backed up by the most absurd claims for usefulness, and are thereby used freely, with positive detriment to the sufferer.

In a few cases the manufacturers have evidently tried, with more or less success, to produce a flour low in starch and high in proteids. Their products are of such composition that their judicious use may be beneficial. In any case, however, the amount of starch present is high and the flour must be used sparingly. The same results can easily be obtained by diminishing the amount of ordinary bread consumed.

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After correspondence with the manufacturers of those gluten flours that were as represented, and comparison of our results with those of other analysts, we have adopted the following standard for gluten flours:

Gluten flour is flour from which the starch has been washed, wholly or in part. Standard gluten flour must contain at least thirty (30) per cent. of proteids calculated by multiplying the nitrogen content by the factor 6.25, and not over forty-eight (48) per cent. of starch.

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STATE LABORATORY OF HYGIENE.

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LABORATORY OF HYGIENE—BACTERIOLOGICAL DEPARTMENT, CONCORD.

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LABORATORY OF HYGIENE—BACTERIOLOGICAL DEPARTMENT, HANOVER.

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LABORATORY OF HYGIENE—WATER DEPARTMENT.

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LABORATORY OF HYGIENE—FOOD DEPARTMENT.

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STATE LABORATORY OF HYGIENE.

BY IRVING A. WATSON, M. D., DIRECTOR.

The wisdom of the Legislature in providing for the establishing of a State Laboratory of Hygiene under the management of the State Board of Health, has already been proven by the work accomplished. No argument is needed to support this statement other than a presentation of the plain facts connected with the work of that department.

In the last report of the Board a large amount of bacteriological and chemical work was presented. In this report is a still greater exhibit for both departments, showing increased public appreciation of the work of the laboratory in determining questions connected with the health, as well as the financial interests of the individual, the family, and the public. That this work is a direct factor in the saving of human life is a proposition against which no argument can be maintained. On the other hand, the statement is supported by the fact that through these investigations many dangerous water supplies have been discontinued, and notices given in other instances that may have prevented outbreaks of typhoid fever.

In the bacteriological department diseases have been detected, particularly diphtheria, in season to avert exposure and to indicate to the physician early in the disease its true character, and, consequently, by that fact, inferentially suggesting the proper treatment.

Likewise the early detection of tuberculosis, so essential to the treatment of this disease, has been an important feature of the laboratory work. These are a few of the more directly obvious results that have been accomplished.

As further, but perhaps somewhat more indirectly, affecting public health should be mentioned the detection of adulterated foods and drinks. In this particular line much has already been done, not only in pointing out dangerous adulterations, but also commercial frauds that swindle the purchaser.

THE CHEMICAL DEPARTMENT.

The greater part of the work of the chemical department of the laboratory has already been given under Water Supplies of Cities and Towns, and in the Report on the Inspection and Control of Food Products in

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New Hampshire. A study of these reports will give a better idea of the magnitude of the work. During the past two years 1,594 samples of water have been analyzed, of which 713 were found to be contaminated to an extent that rendered them unsuitable for domestic use.

More or less frequent examinations have been made of the public water supplies of the state, and in addition thereto analyses have been made of many private supplies. The demand from these sources has become so great that it has been necessary to establish certain rules to govern the matter, as follows:

THE STATE OF NEW HAMPSHIRE.

STATE BOARD OF HEALTH.

REGULATIONS GOVERNING THE EXAMINATION OF PRIVATE WATER SUPPLIES AT THE STATE LABORATORY OF HYGIENE.

I. A person desiring the analysis of a private water supply must fill out an application blank, stating the reasons for such a request fully and explicitly.

II. No water will be examined simply to satisfy the curiosity of any one, or to substantiate a belief that the water is of good quality. There must be some valid reason given.

III. Examinations will be made:

1. If there is sickness or ill health among persons using the water, of a character that might reasonably be charged to its use.
2. If the appearance of the water indicates contamination.
3. If it has an unnatural taste.
4. If it has an unusual odor.
5. If it is abnormally colored.
6. If the attending physician, or the local board of health, requests an analysis.
7. If it is desired to ascertain if water received through lead pipe from a spring contains an amount of lead that would render it unfit for domestic use.
8. If it is wanted to ascertain if the water in an old, abandoned well, which it is proposed to re-open, is suitable for family use.
9. If for any other cause which may be deemed sufficient by the State Board of Health to warrant an analysis.

IV. In the event that an application for water analysis is granted, a container, with full directions for collecting the sample, will be sent to the applicant, express charges prepaid. No charge will be made for the analysis; but the party sending the sample must prepay express charges on the same to the State Laboratory of Hygiene.

NOTICE CONCERNING THE ANALYSIS OF PRIVATE WATER SUPPLIES.

It is not the practice of state boards of health to analyze private water supplies. Work of this kind is usually limited to the examination of public supplies

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of towns and villages. But, having a desire to serve the people of the state as far as possible, no regulations or restrictions have hitherto been made concerning waters forwarded to the State Laboratory of Hygiene for examination. As a result, we have made many analyses of private supplies, wells, springs, etc., that were perfectly good waters, and no suspicions existed to the contrary.

It has come to a point that the demand for work of this kind is so great as to over-tax the working capacity of the laboratory, to the exclusion, or rather, the limitation of food analysis, and other investigations of public health importance.

We are, therefore, obliged to establish what we believe to be not unreasonable requirements to govern our future work in this direction.

Hereafter we shall require an application blank to be filled out in all cases.

If your desire for an analysis comes within the scope of the regulations given above, please fill out the blank as fully as possible and forward to this office. Upon receipt of the same the matter will be given prompt attention.

IRVING A. WATSON,
Secretary.

November 1, 1904.

The blank referred to, which is required to be filled out in every instance, is as follows:

THE STATE OF NEW HAMPSHIRE.

STATE BOARD OF HEALTH.

LABORATORY OF HYGIENE.

APPLICATION FOR WATER ANALYSIS.

To the State Board of Health, Concord, N. H.

I desire to have a sample of water, concerning which the following facts are given, analyzed at the State Labratory of Hygiene:

The supply is from (well, pond, stream, spring or public water supply)

The water is being used for

The reason for such request is as follows:

The following additional facts are given:

(Signed)

Date 190 . (P. O. Address)

(Express Office)

☞ **Read "Regulations Governing the Examination of Private Water Supplies at State Laboratory of Hygiene," before filling this blank.**

In the food department 1,292 articles have been examined, of which 779 were found to be of doubtful quality, and 613 either adulterated or

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varying from the legal standard. This represents 39.7 per cent. of adulterations.

One hundred and sixty-three samples of liquor have been analyzed, most of which work was for the State Board of License Commissioners, as provided for in the act creating that board.

BACTERIOLOGICAL DEPARTMENT.

The work of this department is constantly increasing. Its importance as an aid to the physician in the diagnosis of diseases and to the health officer for release purposes in diphtheria is being more and more appreciated, as shown by the increasing number of examinations required from these sources.

During the period covered by this report 5,688 bacteriological examinations were made, exclusive of a large number of tests for the colon bacillus in water supplies. These figures represent a great amount of work.

Occasional requests are made for examinations that do not come within the regular scope of the laboratory work, hence have to be refused. Under this head are included general pathological examinations, blood counts, urinary analyses, the examination of stomach or other organs in cases of suspected poisoning, etc.

Within the legal scope of the laboratory are examinations for the detection of tuberculosis, diphtheria, typhoid fever, gonorrhœa, glanders, micro-organisms in drinking water, milk, cream, butter, etc., and for diseased conditions found in slaughtered animals.

A tabulated statement of the work of this department, by years, is herewith given:

BACTERIOLOGICAL EXAMINATIONS AT STATE LABORATORY OF HYGIENE FOR TWO YEARS ENDING OCTOBER 1, 1904.

Year.	For tuberculosis.	For diphtheria.	For typhoid fever.	For malaria.	For gonorrhœa.	Various special examinations.	For B. coli in water supplies.
1903.....	1,021	1,017	199	25	9	.....	Many.
1904.....	1,269	1,851	283	20	30	14	Many.
Total.....	2,290	*2,868	432	45	39	14	.....

Following will be found some statistical tables on the investigations of the diseases referred to. A brief analysis of results, with comments, follows each table:

* Including 163 examinations of school children, not shown in subsequent tables.

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SPUTUM EXAMINATIONS, 1903.

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Acworth	5	2	3	..	..	....	2	1	....	....	1	....	1	....	2	3	..	10
Alstead	1	1	...	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Andover	3	2	1	..	..	2	1	....	....	....	....	....	....	....	2	1	..	3
Antrim	3	1	2	..	1	....	....	....	1	....	1	....	....	....	2	1	..	3
Ashland	16	7	9	..	..	5	5	5	....	....	....	....	....	1	6	10	..	19
Barrington	5	1	4	..	..	....	2	....	1	1	1	....	....	....	1	4	.	6
Bartlett	1	1	....	..	..	....	....	....	....	....	....	....	....	1	....	1	..	1
Belmont	2	....	2	..	..	....	....	1	....	....	....	1	....	....	1	1	..	2
Bennington	2	1	1	..	..	1	....	....	....	....	....	1	....	...	1	1	..	2
Berlin	21	5	16	..	2	2	7	6	1	....	1	1	....	1	3	18	..	21
Bethlehem	7	4	3	..	..	....	1	3	2	1	....	....	....	....	2	5	..	8
Bristol	7	2	5	..	..	1	3	....	3	....	....	....	....	....	3	4	..	7
Brookline	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	..	..	1
Campton	3	1	2	..	..	....	....	....	1	....	1	1	....	....	2	1	..	3
Candia	1	....	1	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Center Harbor	3	1	2	..	..	2	....	1	....	....	....	....	....	....	2	1	..	3
Charlestown	1	....	1	..	..	....	....	....	1	....	....	....	....	....	1	....	..	1
Claremont	12	4	8	..	..	1	3	3	1	2	2	....	....	....	7	5	..	15
Colebrook	2	....	2	..	..	2	....	....	....	....	....	....	....	....	....	2	..	2
Concord	138	45	93	..	3	12	39	36	12	9	6	....	....	21	68	68	2	165
Conway	2	1	1	..	..	....	2	....	....	....	....	....	....	....	....	2	..	2
Cornish	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Deerfield	1	1	....	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Derry	7	4	3	..	..	....	2	2	3	....	....	....	....	....	4	3	..	8
Dover	31	8	23	..	..	4	14	5	2	1	3	2	....	....	19	12	..	36
Effingham	1	1	....	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Enfield	1	1	...	..	..	....	....	....	1	....	..	....	....	....	1	....	..	1
Epping	5	2	3	..	..	...	1	1	2	1	....	....	....	....	2	3	..	5
Epsom	3	1	2	..	..	....	1	....	2	....	....	....	....	....	....	3	..	6
Exeter	20	5	15	..	..	7	4	1	3	4	....	1	....	....	7	13	..	21
Farmington	3	....	3	..	..	1	....	....	....	....	1	1	....	....	2	1	..	3
Fitzwilliam	1	....	1	..	..	....	....	....	1	....	...	....	....	....	....	1	..	3
Franconia	1	....	1	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Franklin	27	7	20	..	1	4	2	3	3	2	3	2	....	2	3	19	..	30

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SPUTUM EXAMINATIONS, 1903.—*Continued.*

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Goffstown	1	1	....	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Gorham	1	1	....	..	..	....	....	....	....	1	....	....	....	....	1	....	..	1
Greenfield	3	....	3	..	..	1	2	....	....	....	....	....	....	....	2	1	..	3
Greenland	13	4	9	..	..	....	4	8	....	1	....	....	....	....	4	9	..	13
Greenville	2	1	1	..	..	....	1	1	....	....	....	....	....	....	....	2	..	2
Hanover	49	7	42	..	..	5	18	8	3	10	3	....	1	1	34	15	..	63
Hampton	5	3	2	..	..	1	2	....	1	....	1	....	....	....	1	4	..	5
Haverhill	18	5	13	..	..	2	3	7	1	3	....	1	....	1	10	8	..	23
Henniker	2	....	2	..	..	1	....	1	....	....	....	....	....	....	1	1	..	2
Hill	4	2	2	..	..	....	3	1	....	....	....	....	....	....	1	3	..	6
Hillsborough	13	6	7	..	..	4	4	2	1	1	....	....	....	1	5	8	..	13
Hinsdale	1	....	1	..	.	....	....	....	....	....	....	1	....	....	1	....	..	1
Hooksett	3	2	1	..	..	....	....	....	....	....	....	....	....	3	1	....	2	3
Hopkinton	2	....	2	..	..	....	2	....	....	....	....	....	....	....	1	1	..	3
Jefferson	2	....	2	..	..	....	....	....	1	....	....	1	....	....	....	2	..	2
Keene	9	1	8	..	1	3	....	1	1	....	1	2	....	....	6	3	..	13
Laconia	19	5	14	..	1	5	4	6	....	....	1	....	....	2	9	8	2	21
Lancaster	19	10	9	..	..	5	6	2	3	1	1	....	....	1	9	10	..	19
Lebanon	30	9	21	..	..	6	9	6	3	3	1	....	....	2	17	13	..	41
Lisbon	9	2	7	..	..	....	3	2	3	....	1	....	....	....	5	4	..	9
Littleton	13	7	6	..	..	2	4	2	1	3	....	....	....	1	7	5	1	15
Londonderry	1	1	....	..	..	1	....	....	....	....	....	....	....	....	....	1	..	1
Lyme	1	..	1	..	..	....	....	....	1	....	....	....	....	....	....	1	..	2
Manchester	74	29	45	..	1	5	26	15	13	6	....	....	....	8	25	46	3	81
Milford	10	6	4	..	..	....	3	2	5	....	....	....	....	....	7	3	..	10
Mont Vernon	1	....	1	.	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Nashua	65	24	41	..	1	11	15	13	11	12	....	1	....	1	28	36	1	71
New Boston	4	....	4	..	..	....	1	2	....	....	....	1	....	....	1	3	..	4
New Hampton	2	....	2	..	..	....	....	....	1	....	1	....	....	....	1	1	..	2
New Ipswich	1	1	....	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Newmarket	3	1	2	..	..	....	....	2	....	1	....	....	....	....	1	2	..	3
Newport	5	3	2	..	..	....	....	1	2	....	1	....	....	1	1	3	1	6
Northumberland	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Northwood	2	....	2	..	..	2	....	....	....	....	....	....	....	....	1	1	..	2

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SPUTUM EXAMINATIONS, 1903.—*Concluded.*

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Nottingham	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Orford	1	....	1	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Ossipee	3	...	3	..	..	1	....	1	1	....	....	....	....	....	....	3	..	3
Pembroke	8	6	2	..	..	3	2	1	....	....	....	....	....	2	2	6	..	11
Peterborough	1	1	....	..	.	....	1	....	....	....	....	....	....	....	....	1	..	1
Pittsburg	1	1	....	..	..	....	....	....	....	1	....	....	....	....	....	1	..	1
Pittsfield	1	....	1	..	..	....	....	....	....	....	....	....	....	1	....	1	..	1
Plaistow	1	....	1	..	..	....	....	1	...	....	....	....	....	....	....	1	..	1
Plymouth	5	1	4	..	..	1	2	2	....	....	....	....	....	....	1	4	..	5
Portsmouth	34	14	20	..	2	2	15	9	2	1	2	1	....	....	11	23	..	46
Rochester	17	7	10	..	..	1	1	7	2	3	2	1	....	....	13	4	..	20
Rye	1	....	1	..	..	....	....	....	1	....	....	....	....	....	....	1	..	1
Somersworth	15	8	7	..	..	1	5	5	1	2	1	....	....	....	7	8	..	19
Stewartstown	4	....	4	..	1	...	....	1	2	....	....	....	....	....	2	2	..	4
Stratford	4	2	2	..	..	2		....	....	....	....	....	....	....	1	3	..	4
Sunapee	5	....	5	..	..	1	1	....	1	1	1	....	....	....	3	2	..	6
Suncook	12	5	7	..	..	3	2	3	3	....	1	....	....	....	5	7	..	12
Swanzey	2	1	1	..	..	....	....	1	....	....	1	....	....	....	....	2	..	2
Tilton	6	1	5	..	..	1	1	1	1	....	1	....	....	1	4	2	..	7
Wakefield	2	2	....	..	..	....	1	....	1	....	....	....	....	....	1	1	..	2
Walpole	2	2	...	..	..	....	1	....	1	....	....	....	....	....	....	2	..	2
Warner	2	2	....	..	..	....	....	....	1	1	....	....	....	....	....	2	..	5
Warren	1	1	....	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Wentworth	2	1	1	..	..	....	....	1	....	....	....	1	....	....	1	1	..	2
Whitefield	6	....	6	..	..	....	2	1	1	1	....	....	....	1	1	4	1	7
Wilton	6	1	5	..	..	1	....	2	2	....	1	....	....	....	3	3	..	6
Winchester	4	....	4	..	..	....	1	2	....	....	....	....	....	1	1	2	1	4
Wolfeborough	4	2	2	..	..	1	....	1	2	....	....	....	....	....	3	1	..	4
Total	877	298	579	..	14	118	243	199	113	73	41	20	2	54	392	471	14	1021

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SPUTUM EXAMINATIONS, 1904.

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Acworth	5	2	3	..	..	....	4	1	....	....	....	....	....	....	2	3	..	5
Alstead	3	....	3	..	..	1	....	....	1	1	....	....	....	....	2	1	..	3
Alton	1	....	1	..	..	....	....	....	....	....	1	....	....	....	1	....	..	1
Andover	4	1	3	..	..	....	4	....	....	....	....	....	....	....	....	4	..	4
Antrim	6	2	4	..	1	1	1	....	2	....	1	....	....	....	5	1	..	6
Ashland	13	5	8	..	..	2	6	3	2	....	....	....	....	....	6	7	..	13
Barrington	7	1	6	..	..	1	1	....	....	....	2	3	..	....	5	2	..	17
Belmont	2	....	2	..	..	....	....	....	1	....	....	1	....	....	....	2	..	2
Bennington	2	...	2	..	..	....	....	....	1	....	1	....	....	....	2	....	..	2
Berlin	24	5	19	..	1	....	3	9	6	....	....	....	....	....	9	15	..	25
Bethlehem	12	4	8	..	..	1	2	4	3	2	....	....	....	....	5	7	..	13
Boscawen	1	....	1	..	..	....	....	....	....	1	....	....	....	....	1	....	..	1
Bradford	1	1	....	..	..	....	....	....	....	....	....	....	....	1	1	....	..	1
Bristol	6	1	5	..	..	....	1	2	1	....	2	....	....	....	4	2	..	6
Brookline	1	....	1	..	..	....	....	....	....	....	1	....	....	....	....	....	1	1
Canaan	2	1	1	..	..	....	....	1	1	....	....	....	....	....	1	1	..	2
Center Harbor	1	....	1	..	..	....	....	..	....	1	....	....	....	....	....	1	..	1
Charlestown	5	2	3	..	..	....	....	3	....	....	2	....	....	....	2	3	..	5
Claremont	19	2	17	..	2	....	4	3	4	4	1	1	....	....	11	8	..	21
Concord	156	47	109	..	6	13	48	41	18	12	6	1	1	10	74	82	..	188
Conway	3	3	....	..	..	1	1	1	....	....	....	....	....	....	1	2	..	3
Derry	6	1	5	..	..	....	1	2	1	1	....	1	....	....	4	2	..	6
Dover	58	27	31	..	1	4	26	16	6	1	4	....	....	....	22	36	..	61
Enfield	9	3	6	..	..	1	3	1	4	....	....	....	....	....	7	2	..	13
Epping	4	....	4	..	..	....	1	3	....	....	....	....	....	....	....	4	..	4
Exeter	18	8	10	..	..	2	5	9	...	....	1	....	....	1	5	13	..	23
Farmington	10	1	9	..	..	....	1	6	....	1	1	....	....	1	3	7	..	12
Fitzwilliam	3	1	2	..	..	....	....	1	1	....	1	....	....	....	1	2	..	3
Franklin	25	9	16	..	..	3	5	7	3	2	3	...	1	1	11	14	..	27
Gilmanton	2	2	....	..	..	....	1	1	...	....	....	....	....	....	1	1	..	2
Goffstown	6	3	3	..	..	1	1	....	....	3	....	1	....	....	3	3	..	6
Gorham	4	4	....	..	..	....	1	1	....	2	....	....	....	....	1	3	..	4
Greenville	3	....	3	..	..	1	1	....	....	....	....	....	....	1	1	2	..	3
Hampton	2	1	1	..	..	....	....	1	1	...	....	....	....	....	....	2	..	2

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SPUTUM EXAMINATIONS, 1904.

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Hanover	42	7	35	..	1	4	14	8	7	4	2	....	1	1	19	23	..	48
Haverhill	15	3	12	..	..	1	8	4	2	....	....	....	....	....	7	8	..	18
Henniker	3	2	1	..	..	1	....	1	....	....	1	....	....	....	1	2	..	3
Hill	1	1	....	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Hillsborough	4	1	3	..	..	....	....	....	...	1	1	2	....	....	1	3	..	5
Hinsdale	5	1	4	..	..	....	2	1	....	1	1	..	....	....	2	3	..	5
Hopkinton	1	....	1	..	..	....	....	....	....	1	....	....	....	....	1	....	..	1
Hudson	3	....	3	..	..	1	1	....	1	....	....	....	....	....	2	1	..	3
Keene	34	16	18	..	1	1	14	7	3	4	3	....	....	1	13	21	..	38
Laconia	15	5	10	..	..	2	5	3	3	....	1	....	....	1	5	10	..	18
Lancaster	27	7	20	..	1	4	7	3	3	2	1	....	....	1	14	13	..	29
Lebanon	26	8	18	..	1	2	8	7	3	2	2	1	....	....	12	14	..	37
Lempster	3	1	2	..	..	....	1	....	1	1	....	....	....	....	....	3	..	3
Lisbon	13	4	9	..	1	....	4	4	3	....	....	1	....	....	8	5	..	14
Littleton	12	2	10	..	1	1	5	1	2	1	1	....	....	....	6	6	..	12
Loudon	4	2	2	..	..	1	....	1	....	...	....	....	1	1	2	2	..	4
Lyme	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Manchester	187	58	79	..	5	14	40	41	17	10	6	1	....	3	61	76	..	165
Marlborough	2	....	2	..	..	....	....	2	....	....	....	....	....	....	1	1	..	2
Meredith	1	1	....	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Milford	7	5	2	..	..	1	2	1	1	1	....	1	....	....	4	3	..	7
Monroe	1	1	....	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Nashua	54	25	29	..	..	8	13	15	11	4	3	....	....	....	21	33	..	61
New Boston	3	2	1	..	..	....	....	2	....	1	....	....	....	....	1	2	..	3
New Hampton	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
New Ipswich	1	1	....	..	..	....	1	....	...	....	....	....	...	....	1	....	..	1
New London	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Newmarket	3	....	3	..	..	1	1	1	....	....	....	....	....	....	1	2	..	3
Newport	9	5	4	..	..	1	2	...	3	....	2	1	....	....	4	5	..	10
Northumberland	1	....	1	..	..	....	1	....	....	....	....	....	...	....	1	....	..	1
Ossipee	2	2	....	..	..	2	....	....	....	....	....	....	....	....	....	2	..	2
Pembroke	51	36	15	..	..	4	21	14	4	2	....	1	....	5	31	20	..	98
Peterborough	5	2	3	..	..	....	2	1	1	....	....	....	....	1	1	4	..	5
Pittsfield	7	2	5	..	2	1	....	2	2	....	....	....	....	....	2	5	..	9

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SPUTUM EXAMINATIONS, 1904.—*Concluded.*

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Plymouth	5	2	3	..	..	1	3	1	....	....	....	....	....	....	1	4	..	5
Portsmouth	49	20	29	..	1	2	25	10	5	4	2	....	....	....	18	31	..	60
Raymond	1	....	1	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Rochester	20	6	14	..	1	1	4	5	3	4	2	....	....	....	9	11	..	26
Salem	2	...	2	..	..	1	....	1	....	....	....	....	....	....	....	2	..	2
Seabrook	1	...	1	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Somersworth	24	10	14	..	..	1	12	5	4	1	1	....	....	....	6	18	..	29
Stewartstown	4	2	2	..	..	1	2	....	1	....	....	....	....	....	1	3	..	4
Stratford	6	....	6	..	..	....	1	4	....	1	....	....	....	....	2	4	..	8
Sunapee	4	2	2	..	..	....	2	1	1	....	....	....	....	....	1	3	..	7
Swanzey	2	1	1	..	..	....	1	1	....	....	....	....	....	....	1	1	..	2
Tamworth	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Tilton	1	...	1	..	..	....	....	....	....	....	....	1	....	....	1	....	..	1
Troy	1	....	1	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Wakefield	2	....	2	..	..	....	1	....	1	....	....	....	....	....	2	....	..	2
Warner	2	1	1	..	..	....	....	1	....	1	....	....	....	....	....	2	..	2
Warren	1	....	1	..	..	....	....	....	1	....	....	....	....	....	....	1	..	1
Webster	1	1	....	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Wentworth	2	1	1	..	..	1	1	....	....	....	....	....	....	....	....	2	..	3
Whitefield	3	....	3	..	..	1	....	....	1	....	1	....	....	....	1	2	..	3
Wilton	5	....	5	..	..	1	1	....	2	....	....	....	1	...	1	4	..	5
Winchester	4	1	3	..	..	1	....	....	2	1	....	....	....	....	4	....	..	4
Wolfeborough	4	2	2	..	..	....	3	1	....	....	....	....	....	....	1	3	..	5
Woodstock	3	....	3	..	..	....	....	2	1	....	..	....	....	....	3	....	..	3
Total	1067	386	681	..	26	94	337	279	145	78	57	17	5	29	472	594	1	1289

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An examination of the foregoing tables shows that in 1903 sputum for examination was received from 97 cities and towns in the state, and in 1904 from 92. These cities and towns represent the residences of the physicians who forwarded the specimens to the laboratory, and do not, by any means, indicate that the specimens were collected solely in those places. The distribution of these examinations by patients would cover a much greater portion of the state than is represented in the table.

Taking the two years into consideration, as a whole, we find that 2,290 specimens of sputum were examined, representing 1,944 cases, or different individuals. Of these, 684 were positive and 1,260 negative.

All of the positive cases were, of course, tuberculosis (consumption), while the negative results are to be interpreted according to circumstances. It is by no means certain that a greater or less percentage of the persons represented in the negative cases did not have tuberculosis in an incipient stage.

The ages of the persons from whom the specimens were received follow: One to ten, 40; ten to twenty, 212; twenty to thirty, 580; thirty to forty, 478, forty to fifty, 258; fifty to sixty, 151; sixty to seventy, 98; seventy to eighty, 37; eighty to ninety, 7; age not stated, 83. Of the whole number, 864 were males and 1,065 females.

INTERPRETATION OF BACTERIOLOGICAL EXAMINATIONS.

Under this head we wish to emphasize and reiterate substantially what was said in the last report of this board:

Positive Results.—It is to be presumed that in all cases where sputum has been sent to the laboratory for bacteriological examination, there exists in the mind of the attending physician a suspicion of tuberculosis; otherwise he would not have taken the trouble to request an examination, and, of course, when tubercle bacilli are found in such specimens it is definitely determined that the person has some form of the disease. In most cases it is undoubtedly tuberculosis of the lungs, but it may be of the larynx, or some adjacent tissues.

Negative Results.—A single negative result does not prove that the tubercle bacilli do not exist in that case, and should not be considered of any importance to the physician; in fact, should several successive negative results be obtained, proof would still be lacking that the patient might not be infected with the disease, and especially should such results be considered as valueless in the event that there are present in the person some clinical evidences of tuberculosis.

There are many cases of incipient tuberculosis in which the bacilli cannot be found in the sputum, and this is a point which should be constantly

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borne in mind by the medical profession when sending specimens from cases of suspected incipient tuberculosis.

The absence of the bacilli in the sputum in cases of this kind is a result often obtained, for the reason that at this stage there is very little, or no, breaking down of the lung tissue so as to allow the escape of the bacilli into the sputum, and, furthermore, the bacilli might be present in very small numbers, yet escape observation under the microscope.

Negative results are also obtained under other conditions, in a chronic form of the disease of that type known as miliary tuberculosis.

When there is strong clinical evidence of tuberculosis, a negative result should never change the opinion of the attending physician. Successive examinations should be made from time to time, weekly or monthly, as may be deemed best, until there is a reasonable certainty in the case, although no number of negative results should be permitted to counterbalance in any manner well-defined clinical indications of the disease.

REPORT OF EXAMINATIONS IN CASES OF SUSPECTED DIPHTHERIA.

In the following tables are given data of examinations made in the bacteriological department of the State Laboratory of Hygiene for the fiscal years of 1903 and 1904:

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EXAMINATIONS FOR DIPHTHERIA, 1903.

City or Town.	No. of individual cases examined.	No. of specimens examined.	Positive examinations.	Negative examinations.	Doubtful examinations.	Positive cases.	Negative cases.	No. of cases with one negative examination and no more.	No. of cases examined for release.
Alton	1	2	.....	2	.....	.....	1	.....	.....
Andover	2	2	.....	2	.....	.....	2	2	.....
Antrim	4	5	3	2	.....	2	2	2	1
Barrington	2	4	3	1	.....	1	1	1	.....
Belmont	5	5	3	2	.....	3	2	2	.....
Bennington	2	2	.....	2	.....	.....	2	2	.....
Berlin	1	1	.....	1	.....	.....	1	1	.....
Bristol	6	9	3	6	.....	2	4	4	.....
Canterbury	2	2	.....	2	.....	.....	2	2	.....
Chester	8	16	11	4	1	6	2	2	.....
Claremont	2	2	.....	2	.....	.....	2	2	.....
Concord	1102	237	90	147	.....	26	84	76	20
Conway	13	16	8	8	.....	3	5	5	.....
Derry	3	3	1	2	.....	1	2	2	.....
Dover	2	2	.....	2	.....	.....	2	2	.....
Effingham	8	10	7	3	.....	4	4	4	.....
Epping	14	22	9	13	.....	7	7	7	1
Exeter	31	33	19	14	.....	17	14	14	.....
Franconia	2	2	2	.....	.....	2	.....	.....	.....
Franklin	35	52	15	35	2	10	25	21	3
Goffstown	11	26	16	10	.....	9	2	2	3
Goshen	1	1	.....	1	.....	.....	1	1	.....
Hampton	1	1	.....	1	.....	.....	1	1	.....
Hanover	82	98	7	90	1	3	79	76	3
Haverhill. (See, also, Woodsville.)	6	6	.....	6	.....	.....	6	6	.....
Hillsborough	3	3	1	2	.....	1	2	2	.....
Hinsdale	9	11	3	3	.....	6	3	3	.....
Hopkinton	3	3	.....	3	.....	.....	3	3	.....
Hudson	2	2	1	1	.....	1	1	1	.....
Keene	5	8	1	7	.....	1	4	3	.....
Laconia	6	6	2	4	.....	2	4	4	.....
Lancaster	1	1	.....	1	.....	.....	1	1	.....
Lebanon	36	60	28	32	.....	20	16	14	5
Lisbon	11	27	3	24	.....	2	9	4	2
Littleton	6	6	4	2	.....	4	2	2	.....
Lyme	12	15	3	12	.....	3	9	3	2

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EXAMINATIONS FOR DIPHTHERIA, 1903.—*Concluded.*

City or Town.	No. of individual cases examined.	No. of specimens examined.	Positive examinations.	Negative examinations.	Doubtful examinations.	Positive cases.	Negative cases.	No. of cases with one negative examination and no more.	No. of cases examined for release.
Loudon	1	1	.....	1	.....	.....	1	1	.....
Lyndeborough	1	1	1	.....	.....	1	.....	.....	.....
Manchester	10	12	5	7	.....	4	6	6	1
Marlow	1	3	2	1	.....	1	.....	.....	1
Monroe	2	3	1	2	.. ..	1	1	1	1
Meredith	1	1	.....	1	.....	.....	1	1	.....
Milford	17	30	16	14	.....	10	7	6	3
Milton	1	1	.....	1	.....	.....	1	1	....
Nashua	36	38	17	21	.....	17	19	19	.....
New Boston	3	3	3	.....	.....	3	.....	.....	.....
Newmarket	4	4	2	2	.....	2	2	2	.....
Newport	2	3	3	.....	.....	2	.....	.....	.....
New Hampton	1	1	.....	1	.....	.....	1	1	.....
Northwood	1	1	.....	1	.....	.....	1	1	.....
Nottingham	3	6	1	5	.....	1	2	1	1
Orford	1	1	1	.....	.....	1	.....	.....	.....
Ossipee	3	3	3	.....	.....	3	.....	.....	.....
Peterborough	2	2	.....	2	.....	.....	2	2	.....
Pittsfield	1	1	.....	1	.....	.....	1	1	.....
Plymouth	7	7	4	3	.....	4	3	3	.....
Portsmouth	13	16	4	12	.....	4	9	7	1
Rochester	52	104	50	54	.....	24	28	26	23
Salem	2	2	1	1	.....	1	1	1	.....
Stewartstown	1	1	1	.....	.....	1	.....	.....	.....
Swanzey	4	5	1	4	.....	1	3	3	.....
Troy	1	1	.....	1	.....	.....	1	1	.....
Walpole	4	5	2	3	.....	2	2	2	1
Warner	1	1	1	.....	.....	1	.....	.....	.....
Weare	1	1	.....	1	.....	.....	1	1	.....
Webster	1	1	.....	1	.....	.....	1	1	.....
Wentworth	2	2	.....	2	.....	.....	2	2	.....
Wilton	3	3	1	2	.....	1	2	2	.....
Winchester	1	1	.....	1	.....	.....	1	1	.....
Wolfeborough	4	4	2	2	.....	2	2	2	.....
Woodsville. (See, also, Haverhill.)	36	47	20	27	.....	17	19	17	5
Total	672	1017	390	623	4	245	427	394	82

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EXAMINATIONS FOR DIPHTHERIA, 1904.

City or Town.	No. of individual cases examined.	No. of specimens examined.	Positive examinations.	Negative examinations.	Doubtful examinations.	Positive cases.	Negative cases.	No. of cases with one negative examination and no more.	No. of cases examined for release.
Andover	4	5	.....	5	.....	.....	4	3	.....
Antrim	2	2	.....	2	.....	.....	2	2	.....
Ashland	11	17	7	10	.....	3	8	7	1
Bartlett	1	2	1	1	.....	1	.....	.....	.....
Belmont	4	5	2	3	.....	2	2	2	.....
Boscawen	1	2	.....	2	.....	.....	1	.....	.....
Bradford	1	1	.....	1	.....	.....	1	1	.....
Bristol	3	6	3	3	.....	2	1	1	.....
Candia	3	3	.....	3	.....	.....	3	3	.....
Center Harbor	3	3	.....	3	.....	.....	3	3	.....
Chester	1	1	.....	1	.....	.....	1	1	.....
Claremont	5	6	.....	6	.....	.....	5	4	.....
Colebrook	6	8	6	2	.....	4	2	2	.....
Concord	313	793	338	455	.....	82	231	205	71
Conway	3	5	2	3	.....	2	1	1	.....
Derry	4	4	.....	4	.....	.....	4	4	.....
Dover	1	1	.....	1	.....	.....	1	1	.....
Enfield	5	6	6	.....	.....	5	.....	.....	.....
Epping	3	3	.....	3	.....	.....	3	3	.....
Epsom	1	1	.....	1	.....	.....	1	1	.....
Exeter	13	21	11	10	.....	6	7	7	1
Farmington	2	4	.....	4	.....	.....	2	1	.....
Fitzwilliam	2	2	1	1	.....	1	1	1	.....
Franconia	2	2	1	1	.....	1	1	1	.....
Franklin	60	101	30	71	.....	14	46	40	6
Goffstown	2	6	2	4	.....	2	.....	.....	2
Grafton	1	1	.....	1	.....	.....	1	1	.....
Greenfield	1	1	.....	1	.....	.....	1	1	.....
Hanover	44	60	2	58	.....	2	42	34	.....
Haverhill (see Woodsville)	13	14	6	8	.....	6	7	6	.....
Henniker	2	2	.....	2	.....	.....	2	2	.....
Hillsborough	1	.....	1	.....	.....	.....	1	1	.....
Hinsdale	2	5	2	3	.....	2	.....	.....	2
Holderness	1	1	1	.....	.....	1	.....	.....	.....

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EXAMINATIONS FOR DIPHTHERIA, 1904.—*Continued.*

City or Town.	No. of individual cases examined.	No. of specimens examined.	Positive examinations.	Negative examinations.	Doubtful examinations.	Positive cases.	Negative cases.	No. of cases with one negative examination and no more.	No. of cases examined for release.
Hooksett	2	2	.....	2	.....	.....	2	2	.....
Hudson	1	1	.....	1	.....	.....	1	1	.....
Keene	7	8	.....	8	.....	.....	7	7	.....
Laconia	13	17	7	10	.....	4	9	9	.....
Lancaster	4	4	.....	4	.....	.....	4	4	.....
Lebanon	42	72	23	49	.....	12	30	25	3
Lisbon	17	25	5	20	.....	4	13	12	1
Littleton	3	3	1	2	.....	1	2	2	.....
Loudon	2	5	2	3	.....	1	1	1	1
Lyme	7	16	9	7	.....	4	3	3	1
Manchester	107	144	46	98	.....	34	73	71	15
Milford	36	75	25	50	.....	12	24	22	10
Nashua	33	65	26	39	.....	8	25	24	3
New Boston	4	4	.....	4	.....	.....	4	4	.....
Northwood	3	7	4	3	.....	1	2	2	1
Nottingham	1	1	.....	1	.....	.....	1	1	.....
Ossipee	1	1	.....	1	.....	.....	1	1	.....
Orford	1	1	1	.....	.....	1	.....	.....	.....
Northumberland	1	1	.....	1	.....	.....	1	1	.....
Pembroke	1	2	.....	2	.....	.....	1	.....	.....
Peterborough	4	5	1	4	.....	1	3	3	1
Pittsfield	3	3	.....	3	.....	.....	3	3	.....
Plymouth	1	1	.....	1	.....	.....	1	1	.....
Portsmouth	6	6	1	5	.....	1	5	5	.....
Rindge	5	11	7	4	.....	2	3	3	1
Rochester	3	12	.....	12	.....	.....	3	6	.....
Rye	1	1	.....	1	.....	.....	1	1	.....
Salem	2	2	.....	2	.....	.....	2	2	.....
Stewartstown	2	2	.....	2	.....	.....	2	2	.....
Strafford	1	1	.....	1	.....	.....	1	1	.....
Swanzey	2	3	.....	3	.....	.....	2	1	.....
Tilton	1	1	.....	1	.....	.....	1	1	.....
Troy	2	2	2	.....	.....	2	.....	.....	.....
Walpole	11	46	31	15	.....	10	1	1	5

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EXAMINATIONS FOR DIPHTHERIA, 1904.—*Concluded.*

City or Town.	No. of individual cases examined.	No. of specimens examined.	Positive examinations.	Negative examinations.	Doubtful examinations.	Positive cases.	Negative cases.	No. of cases with one negative examination and no other.	No. of cases examined for released.
Warner	2	5	.....	5	.....	.....	2	1	.....
Warren	1	1	1	.....	.....	1	.....	.....	.....
Weare	1	1	.....	1	.....	.....	1	1	.....
Wentworth	1	1	.....	1	.....	.....	1	1	.....
Whitefield	2	2	1	1	.....	1	1	1	.....
Winchester	6	6	2	4	.....	2	4	4	.....
Wolfeborough	7	7	6	1	.....	6	1	1	.....
Woodsville (see Haverhill)	16	21	9	12	.....	8	8	7	3
Total	892	1688	682	1056	.....	252	640	576	128

An examination of the foregoing tables will show that in 1903 swabs taken from suspected diphtheria cases were sent to the laboratory by physicians in 70 towns and cities in the state, and in 1904 from 75.

It should be borne in mind that these towns and cities were the residences of the physicians who patronized the laboratory for the purpose stated, and not the distribution of patients. The number of individual cases should not, therefore, be necessarily credited to the town against which they are placed.

During the year 1903 bacteriological examinations were made in 672 individual cases; in 1904 in 892 cases, exclusive of 163 examinations of school children in the city of Concord.

In reviewing the work of the two years, as a whole, we find that 2,705 examinations were made for the Klebs-Löffler bacillus, representing 1,564 individual cases. Of the specimens examined, 1,022 were positive, 1,679 negative, and four doubtful by reason of poor growths. Of the 1,564 individual cases 497 were positive and 1,067 negative. In 970 cases a single negative examination and no more was made. In the large number of negative results were included many persons who were not suspected of having the disease, but who had been exposed to the infection. This fact also helps to make up the large number of cases in which a single negative examination, and no more, was made; but in what appears to be too many instances the physician was satisfied with one negative report as conclusive in the case. This may possibly be accounted for

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many times by reason of the rapid improvement of the patient by the time the report was received, so that it was not decreed necessary to send a second swab.

Two hundred and ten examinations were made for release purposes. It is gratifying to note that some cities and towns rely upon the laboratory to determine conclusively when cases of diphtheria may be discharged from quarantine without danger to the public, in that they are requiring two consecutive negative results before the patient is released. This has been the practice strictly adhered to in the city of Concord for the past two years, and, in the opinion of the health officer, has resulted in greatly restricting the spread of the disease. We recommend such a course to all local boards of health.

The discovery of the Klebs-Löffler bacillus in a smear, or on a culture growth in the incubator, shows conclusively that the bacillus of diphtheria existed in the throat, nasal passages, or other locality where the swab was used; but it shows nothing more. The virulence of the growth is undetermined. The individual from which it came may be perfectly well, as in some persons who have been exposed to the disease, or they may have what appears to be a mild tonsillitis, or it may be a most malignant case of diphtheria. The microscope gives no information upon these points.

When the diphtheria bacillus is found, the fact is reported to the physician as a "positive" result. This he must accept as a verity, however puzzling it may appear to him clinically. It may be difficult for him in some instances to adjust such a bacteriological diagnosis to his case, but he is, nevertheless, bound to do so, for the laboratory results in all cases reported as "positive" are not open to question.

This cannot be said of results reported as "negative," and whenever such a report is made to the physician he should not allow it to take precedence of the clinical symptoms in making his diagnosis. The case may be diphtheria, without any growth or any indication of the bacillus of that disease appearing in the laboratory. There are various reasons for this. The swab may have been used in a manner not to entrap the bacillus, especially in cases of laryngeal or nasal diphtheria, or an antiseptic may have been used in the throat previous to taking the swab, thus preventing any growth in the laboratory.

We wish to emphasize the fact that in all cases reported negatively, the physician should be guided solely by clinical symptoms. A series of examinations in such cases may positively exclude the Klebs-Löffler bacillus, and demonstrate, positively, some other special form of infection.

Laboratory investigations have proven that no physician, without the

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aid of the microscope, can be absolutely certain of his diagnosis in any form of angina, although presumably his opinion is correct in a great majority of cases. Fatal cases, simulating, clinically, a type of diphtheria, may not be that disease at all, but due to some other form of infection. Likewise what may appear to be a simple tonsillitis may be a mild form of diphtheria. Many cases have been examined bacteriologically in the laboratory of this board, as well as in other laboratories, that prove this assertion.

An interesting and valuable report has been made by Dr. B. H. Stone, bacteriologist of the Vermont State Laboratory of Hygiene, on the study of 81 cases of sore throat, in which 44 showed a membrane, and the cultures were sent to him as suspected diphtheria. Not one of these cases proved to be diphtheria, although the clinical symptoms were very marked at the onset of the cases, but no organisms resembling the diphtheria bacillus were found. The infection was found to be due to a peculiar diplococcus. A few similar results have been observed in the laboratory of this Board. It follows, as has been stated, that the nature of such, and similar cases, can be determined only by bacteriological investigations.

In the last report of this Board was given a list of the stations throughout the state where bacteriological outfits of various kinds were to be found. The list has been considerably increased since that time, so that at the present time these outfits may be obtained at nearly every drug store in the state.

In towns where there is a resident physician, but no drug store, outfits will be sent directly from the laboratory upon request.

BACTERIOLOGICAL EXAMINATIONS IN CASES OF SUSPECTED TYPHOID FEVER.

During the fiscal year 1903, 199 Widal test examinations were made in suspected typhoid fever cases, representing 166 patients. The test resulted positively in 66 cases, and negative in 100. In 1904, 233 examinations were made, representing 194 cases, which resulted positively in 68 cases, and negative in 126. The following tables give the facts more in detail:

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TYPHOID EXAMINATIONS, 1903.

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Antrim	2	1	1	..	..	....	....	1	....	....	1	....	....	....	2	....	..	2
Barrington	2	1	1	..	..	1	....	....	....	....	1	....	....	....	....	2	..	2
Belmont	4	1	3	..	..	....	2	....	2	....	....	....	....	....	3	1	..	4
Berlin	1	1	....	..	1	....	....	...	....	....	....	....	....	....	1	....	..	1
Bristol	1	....	1	..	..	...	....	1	....	....	....	....	....	....	1	....	..	1
Campton	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Center Harbor	1	....	1	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Chesterfield	2	2	....	..	..	2	...	....	....	....	....	....	....	....	2	....	..	2
Claremont	4	1	3	..	..	....	2	1	....	....	1	....	....	....	3	1	..	3
Concord	16	8	8	..	..	4	6	4	....	....	....	....	....	2	10	5	1	18
Derry	2	2	....	..	..	....	2	....	....	....	....	....	....	....	1	1	..	2
Dover	3	....	3	..	..	....	2	....	1	....	....	....	....	....	3	....	..	4
Enfield	1	....	1	..	..	1	...	....	....	....	....	....	....	....	1	....	..	1
Exeter	6	3	3	..	..	2	2	1	....	....	1	....	...	....	5	1	..	6
Farmington	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Franklin	11	4	7	..	1	6	2	1	1	....	....	....	....	....	5	6	..	11
Hanover	12	5	7	..	3	....	6	1	1	1	...	....	....	....	9	3	..	17
Haverhill	6	2	4	..	1	2	2	1	....	....	....	....	....	....	4	2	..	7
Hillsborough	1	....	1	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Hinsdale	1	....	1	..	..	....	....	....	....	1	....	....	....	....	....	1	..	1
Hudson	2	1	1	..	..	....	....	....	1	...	....	1	....	....	1	1	..	2
Keene	2	1	1	..	..	1	1	....	....	....	....	....	....	....	1	1	..	4
Laconia	3	....	3	..	..	1	2	....	....	....	....	....	....	....	1	2	..	3
Lancaster	1	...	1	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Lebanon	2	....	2	..	1	....	....	1	....	....	....	....	....	....	....	2	..	3
Lisbon	1	....	1	..	..	....	1	....	....	....	....	....	....	....	....	1	..	1
Littleton	84	24	10	..	3	11	10	5	1	2	1	....	....	1	19	15	..	39
Manchester	5	1	4	..	..	2	1	....	1	....	....	....	....	1	1	4	..	5
Meredith	1	1	....	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Nashua	13	1	12	..	1	4	5	1	2	....	....	...	....	....	7	6	..	20
Orford	1	1	....	..	..	....	....	....	....	....	....	1	....	....	1	....	..	1
Pembroke	1	....	1	..	1	....	....	....	....	....	...	....	....	....	....	1	..	1
Plymouth	1	....	1	..	1	....	....	....	....	....	....	....	....	....	....	1	..	1
Portsmouth	12	1	11	..	..	2	4	2	1	3	....	....	....	....	3	4	..	14

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TYPHOID EXAMINATIONS, 1903.—*Concluded.*

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Males.	Females.	Not stated.	Number of examinations.
Rochester	2	1	1	..	..	....	1	....	1	....	....	....	....	....	....	2	..	3
Stewartstown	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Tilton	2	1	1	..	..	1	....	1	....	....	....	....	....	....	2	....	..	3
Wakefield	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Walpole	2	2	...	..	1	....	1	....	....	....	....	....	....	....	2	....	..	3
Winchester	1	....	1	..	1	....	....	....	....	....	....	....	....	....	1	....	..	1
Total	166	66	100	..	15	42	55	24	12	7	5	2	....	4	101	64	1	199

TYPHOID EXAMINATIONS, 1904.

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Females.	Not stated.	Number of examinations.
Alstead	2	....	2	..	..	....	2	....	....	....	....	....	....	....	1	1	..	2
Antrim	2	1	1	..	..	....	1	....	....	....	1	....	....	....	1	1	..	2
Barrington	3	1	2	..	..	....	....	....	1	....	....	1	....	1	2	1	..	4
Belmont	2	....	2	..	..	1	....	....	1	....	....	....	....	....	1	1	..	2
Berlin	1	1	....	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Boscawen	1	1	....	..	1	....	....	....	....	....	....	....	....	....	1	....	..	1
Bradford	3	....	3	..	..	....	1	1	....	....	..	....	....	1	2	....	1	3
Bristol	1	....	1	..	..	....	....	....	1	....	....	....	....	....	1	....	..	1
Center Harbor	2	1	1	..	1	....	....	1	....	....	....	....	....	....	....	2	..	2
Claremont	7	1	6	..	2	....	2	2	....	1	....	....	....	....	2	5	..	7
Concord	37	14	23	..	6	7	7	10	4	1	1	....	....	1	23	14	..	52
Conway	3	2	1	..	..	1	....	2	....	....	....	....	....	....	1	2	..	6
Dover	3	....	3	..	..	1	1	1	...	....	....	....	....	....	1	2	..	3
Enfield	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Exeter	6	2	4	..	..	2	3	....	....	....	1	....	....	....	3	3	..	6
Farmington	2	....	2	..	..	1	...	1	....	....	....	....	....	....	1	1	..	2
Franklin	33	17	16	..	2	8	15	5	1	1	....	....	....	1	17	16	..	40
Hampton	1	....	1	..	..	....	...	1	....	....	....	....	....	....	....	1	..	1

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TYPHOID EXAMINATIONS, 1904.—*Concluded.*

City or Town.	Number of cases examined.	Positive.	Negative.	Doubtful.	1 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	Age not stated.	Male.	Female.	Not stated.	Number of examinations.
Hanover	17	4	13	..	..	2	6	3	4	1	....	1	....	....	12	5	..	24
Henniker	2	....	2	..	..	1	....	1	....	....	....	....	....	....	....	2	..	2
Hinsdale	3	....	3	..	..	....	....	....	....	2	1	....	....	....	1	2	..	3
Hudson	1	....	1	..	1	....	....	....	....	....	....	....	....	....	1	....	..	1
Keene	1	1	....	..	..	....	....	1	....	....	....	....	....	....	....	1	..	1
Laconia	1	1	....	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Lebanon	5	3	2	..	..	1	2	....	1	....	....	....	....	1	3	2	..	7
Lisbon	1	....	1	..	..	....	....	....	1	....	....	....	....	....	1	....	..	2
Littleton	3	4	4	..	2	2	3	1	....	....	....	....	....	....	4	4	..	8
Manchester	4	1	3	..	..	....	2	....	....	2	....	....	....	....	2	2	..	5
Milford	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Nashua	9	4	5	..	1	....	1	3	2	....	1	....	....	1	3	6	..	11
New London	1	....	1	..	..	....	....	1	....	....	....	....	....	....	1	....	..	1
Newport	3	....	3	..	1	....	1	1	....	....	....	....	....	....	2	1	..	3
Northwood	2	....	2	..	..	...	1	1	....	....	....	....	....	....	2	....	..	2
Peterborough	3	4	4	..	1	4	2	1	....	....	....	....	....	....	5	3	..	8
Portsmouth	4	1	3	..	..	....	1	1	2	....	....	....	....	....	2	2	..	4
Stewartstown	2	....	2	..	..	2	....	....	....	....	....	....	....	....	2	....	..	2
Stratford	3	2	1	..	..	2	1	....	....	....	....	....	....	....	1	2	..	3
Sutton	1	1	....	..	..	....	....	....	....	....	....	....	...	1	....	1	..	1
Tamworth	1	....	1	..	..	....	1	....	....	....	....	....	....	....	1	....	..	1
Wakefield	2	....	2	..	..	....	....	2	....	....	....	....	....	....	1	1	..	2
Warner	2	1	1	..	..	....	1	1	....	....	....	....	....	....	2	....	..	2
Whitefield	1	....	1	..	..	1	....	....	....	....	....	....	....	....	1	....	..	1
Wolfeborough	1	....	1	..	..	....	....	....	....	....	1	....	....	....	....	1	..	1
Total	194	68	126	..	18	36	56	43	18	8	6	2	....	7	108	85	1	288

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The total number of examinations for the two years embraced in this report was 432, the blood for examination being taken from 360 patients, with a result of 134 positive cases, and 226 negative. Of the patients, 209 were males and 149 females; two, sex not stated. The ages of the patients were as follows: one to ten, 33; ten to twenty, 78; twenty to thirty, 111; thirty to forty, 67; forty to fifty, 30; fifty to sixty, 15; sixty to seventy, 11; seventy to eighty, 4; age not stated, 11.

We believe that the importance of the Widal Test, especially in cases where the diagnosis is somewhat doubtful, is not generally recognized, for in many such cases it determines the nature of the disease, which knowledge is of considerable importance, particularly if the reaction is positive, in that it gives the physician and the health officer all the evidence required in safe-guarding others against the spread of the disease. The physician understands better how to treat his patient, insists that disinfection of excreta shall be carried out, and takes all the protective measures known to limit the disease to that individual case.

Concerning the Widal reaction, every physician should understand that certain exceptions to the rule are not to be entirely ignored, and that whatever result is reported these should be taken into consideration. The more prominent exceptions to be noted are:

First. The patient may have typhoid fever and the blood not give the Widal reaction.

Second. The Widal reaction may take place in other conditions than typhoid.

In over 3,000 cases of supposed typhoid fever collected by Cabot five per cent. failed to give the reaction in any stage of the disease, and in a large number of cases, not typhoid, two per cent. gave positive reactions.

Park gives positive results in a large series of cases, by periods, as follows:

During the first week in 20 per cent. of the cases.
During the second week in 60 per cent. of the cases.
During the third week in 80 per cent. of the cases.
During the fourth week in 90 per cent. of the cases.
During the second month in 75 per cent. of the cases.

Some of the conditions other than typhoid that have given a positive reaction, as reported by creditable authorities, are malaria, pneumonia, tuberculosis, otitis, influenza, typhus, meningitis, measles, normal serum.

It will therefore be seen that the laboratory report upon a specimen of supposed typhoid blood, whether positive or negative, must be considered in connection with the clinical aspects of the case, bearing also in mind exceptions as have been noted. Viewed from such a standpoint the

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Widal test may be of inestimable service in aiding the physician in arriving at a correct diagnosis.

EXAMINATIONS FOR MALARIA.

Year.	Number of Examinations.	Positive.	Negative.
1903.	25	1	24
1904.	20	1	19
Total.....	45		

EXAMINATIONS FOR GONOCOCCI.

Year.	Number of Examinations.	Positive.	Negative.
1903.	9	4	5
1904.	30	15	15
Total.....	39		

MISCELLANEOUS EXAMINATIONS.

Pus for streptococci: four; positive, three; negative, one.
Tissue for tuberculosis: seven; positive, five; negative, two.
Fæces for tuberculosis: three; all negative.

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DIPHTHERIA: ITS RESTRICTION AND PREVENTION.

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DIPHTHERIA:

ITS

RESTRICTION AND PREVENTION.

ISSUED BY THE

STATE BOARD OF HEALTH

OF NEW HAMPSHIRE.

Issued for gratuitous distribution throughout the state.

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NOTE.*

This document is published for general distribution among the people of New Hampshire, in order that a wider and more general knowledge of the means and measures necessary to the restriction and prevention of diphtheria may be disseminated.

Local boards of health and physicians are requested to see that a copy of this Bulletin is placed in the hands of every family in which a case of diphtheria appears. It is also recommended that families living in the immediate vicinity of a case be supplied with a copy. At such a time greater interest is taken in everything that has a bearing upon the subject, hence the information which this circular contains will be more carefully studied and its recommendations more firmly fixed in mind.

Copies will be furnished for the purpose stated upon application to STATE BOARD OF HEALTH, Concord, N. H.

* Ten thousand copies of this document were printed in pamphlet form by the Board in March, 1904. Over 6,000 copies have already been distributed.

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DIPHTHERIA:

ITS RESTRICTION AND PREVENTION.

ISSUED BY THE STATE BOARD OF HEALTH OF NEW HAMPSHIRE.

Diphtheria is a contagious and infectious disease. Children are far more susceptible to it than adults, although persons in all periods of life fall victims to it. Its greatest mortality is in children between two and ten years of age.

Membranous croup is another form of diphtheria (laryngeal diphtheria), the membrane, or exudation, being limited to the upper part of the windpipe. Membranous croup, or diphtheritic croup, and diphtheria are the same disease, differing only in manifestations; therefore the same precautions apply in either case. The disease is caused by a germ which finds its way to the throat or upper air passages (and exceptionally to other mucous surfaces) and grows, forming the membrane and creating a poison which is absorbed by the system, producing the characteristic constitutional symptoms with attendant dangers.

The disease is spread by this germ, which exists in immense numbers in the secretions of nose, throat and mouth, and from which persons and things become infected. The germ may live for a considerable period of time in clothing, rags, on toys, dishes, furniture, carpets, and, in fact, on almost anything that has been brought in contact with the patient of the sick-room. The disease is propagated in the body, and is spread from person to person, either directly or indirectly, through infected persons or things.

The germs may be carried in the throat or nose, in exceptional cases, for two or three weeks, sometimes longer, after the patient appears to be entirely well; likewise other members of the family or the nurse may have an infected throat without contracting the disease, and in this way act as unconscious carriers of it.

Formerly it was supposed that diphtheria might arise, *de novo*, from filthy local conditions, but modern researches have disproven this theory; however, that scarcely lessens the importance of sanitation. Nothing favors the invasion or intensifies the ravages of the disease so much as unsanitary environments, and so often has this been observed that diphtheria has sometimes been called a filth disease. Soil conditions which cause dampness of habitations, undrained cellars, neglected sink drains, cesspools and privies, sewer gas, unventilated rooms without sunlight, polluted drinking water, in fact all unsanitary conditions conduce to this malady by depressing the vital forces of resistance, thus preparing the mucous membrane of the respiratory tract for the more favorable reception of the organism of diphtheria.

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It should be borne in mind that diphtheria may exist in any degree of severity from a simple sore throat, scarcely noticeable, to that of the most malignant type.

The slightest sore throat should not be neglected, especially when diphtheria exists in the vicinity, and particularly if there is any probability, or even possibility, of there having been exposure to the infection of the disease. Not infrequently have so-called cases of tonsillitis and pharyngitis been proven, upon bacteriological examination, to be diphtheria.

The schoolroom is an open field for infection.* A greater number of cases occur in autumn, following the opening of public schools, than at any other period of the year. Schoolroom outbreaks are not uncommon. A single infected pupil may communicate the disease to the extent of starting an epidemic. The avenues of infection are many: using the same drinking cup, exchanging pencils, books, chewing gum,† kissing and other practices.

Diphtheria is, without doubt, sometimes spread by a person who has recently had the disease, and who has been discharged from all restrictions as fully recovered without a bacteriological examination to determine whether or not the germs still remain in the throat—as they sometimes do for several weeks following apparent recovery.

No child who has a sore throat of any kind should be allowed to attend school.‡ Whenever diphtheria is present in the town or locality, the mildest form of sore throat should be looked upon with suspicion. It would be better to call a physician in such cases if there is any reason to believe that the disease is diphtheria; but if no physician is in attendance, the Board of Health must be notified of the suspicion.§

* Several cases of diphtheria appeared among the pupils of a certain school in this state. It was evident that the infection was received in the schoolroom, therefore a physician was engaged to make a daily inspection of the pupils. One child with a slight redness of the throat was sent home. The child was not ill; was apparently as well as usual; the parents protested. To determine whether or not the case was diphtheria, swabs were sent to the State Laboratory of Hygiene. Following is the record:

November 20, child sent home from school. November 21, diphtheria bacilli found in throat. November 23, ditto. November 28, ditto. November 30, ditto. December 1, ditto. December 2, diphtheria bacilli not found. December 3, bacilli not found.

Here was a child carrying the germs of diphtheria in its throat for eleven days after discovery, with no clinical symptoms of the disease. Other cases similar to this have been observed.

Doubtless unsuspected and unrestricted cases of this character have spread the disease and are sometimes responsible for epidemics among school children.

† The Board of Health of the city of Manchester recently reported it as the opinion of that board that a schoolroom outbreak of diphtheria in that city was due chiefly to passing from person to person a stick, upon the end of which was a ball of candy, each testing its saccharine qualities.

‡ "SECT. 7. [Chapter 16, Laws of 1901.] No parent, guardian, person, or persons having the custody of any child shall permit such child, if infected with any communicable disease, or has been exposed to such, to attend any public or private school."

§ SECT. 2. [Chapter 16, Laws of 1901.] Whenever any person knows or has reason to believe that any member of his family or household [boarder, roomer or visitor], has either smallpox, diphtheria, membranous croup, scarlet fever, typhoid fever, measles, or any other malignant communicable disease, he shall, within twenty-four hours, if no physician is in attendance, give notice thereof to the local board of health of the town or city in which he resides, or by a communication addressed to the board of health and duly mailed within the time specified."

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MANAGEMENT OF CASES.

1. **When a child or young person** is taken with sore throat, especially if accompanied with fever, it should be separated from all others until it be ascertained that it is not diphtheria, particularly if the disease exists in the town or vicinity.

2. **Every person known to have diphtheria** should be isolated immediately from the public, and all members of the family excepting those necessary to attend the case, and no one else should be allowed to visit the patient. The mother, or nurse, should not mingle with other members of the family if avoidable; if not, they should wear a washable garment completely covering the body, with a cap to cover the hair, both to be removed when leaving the room.

3. **If the case is believed to be diphtheria,** and no physician has been called or is to be called immediately, the board of health must be notified of the case.*

4. **The patient's room** should be as far from the family rooms as possible, preferably in the upper story, and should be prepared by removing all superfluous furniture, carpets, curtains, extra clothing, books, etc., and all other articles NOT NEEDED in the room. AN ABUNDANCE OF FRESH AIR should be provided without subjecting the patient to drafts.

5. **It is the duty of the attending physician** when first called to a case, if the local board of health cannot take charge of it immediately, to place the premises in quarantine if the public is likely to be endangered.†

6. **All discharges from the throat, mouth, and nose** are very dangerous, as they are the carriers of the diphtheria bacillus in vast numbers. They should be received upon rags, or pieces of cloth, and if not immediately burned, should be immersed in a disinfectant solution. (See disinfectants to be employed.)

7. **All discharges from the kidneys and the bowels** are dangerous, and should pass into vessels containing a disinfectant solution, and should remain there for an hour or longer before being disposed of. Vomited matter should be received in a vessel containing a like solution. The disinfectant solution should always be at hand ready for use.

8. **The clothing, bed linen, towels, etc.,** used by the patient should, before being taken from the room, be placed in a tub or pail containing a disinfectant solution (see disinfectants to be employed), and allowed to remain there a few hours, when they may be removed to the wash-room or laundry.

9. **Knives, forks, spoons, glasses, cups, saucers, plates, napkins,** in fact all articles used by the patient should be immersed in a disinfectant solution before being removed from the room. Dust and dirt should be removed by a cloth dampened with the disinfectant solution, as dusting and sweeping are objectionable.

10. **Nurses and attendants** should be required to keep themselves and the patient as clean as possible, and their hands should be frequently washed in the disinfectant solution.

* See footnote (Sect. 7), page 28.

† "SECTION 1. [Chap. 16, Laws of 1901.] A physician called upon to attend a sick person, and who finds the cause of such sickness to be of a contagious or infectious character and the general public likely to be endangered thereby, may quarantine such person's residence at once and report the fact to the board of health. Such quarantine shall continue in force until relieved or revoked by the board of health." A pocket quarantine placard for above named purpose will be furnished any physician upon application to State Board of Health.

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11. **All persons recovering from diphtheria** should be considered dangerous for several weeks from the beginning of the disease, or until bacteriological examinations of the throat have proven the patient to be free from the bacillus of the disease. Patients who have not had such examinations, showing them to be no longer liable to communicate the disease to others, should not be allowed to attend school, church, or to appear in public until after the throat and any sores that may have appeared on the lips or nose have entirely healed, nor until in the judgment of a careful and intelligent health officer or physician he can do so without endangering others, nor until after all of his clothing that has been exposed to infection has been thoroughly disinfected—and this without regard to the time which has elapsed since apparent recovery.

The practice of requiring patients who have had diphtheria to be held in quarantine a certain number of days or weeks, without respect to the type of the disease or other considerations, is unscientific, and in some instances allows the release of the patient before the throat is free from the germs of the disease. In other cases the patient is held in isolation, with attendant expenses, etc., longer than is necessary.

We therefore recommend and strongly urge that bacteriological examinations be required for release purposes, commencing the examination a week or ten days after the patient is convalescent and apparently free from the disease, and that two or, better still, three negative results be required from swabs taken on successive days. In the event that this method of determining the time when a patient may be safely released from quarantine cannot be carried out, the case should be held for at least two weeks after all symptoms of the disease have disappeared.

12. **The bodies of persons dead of diphtheria** should, preferably, be wrapped in a sheet saturated with one of the disinfectant solutions and immediately buried; but should there be any good reason for any other course, a licensed embalmer should be employed, who will prepare the body for interment or for transportation according to the rules and regulations in force to govern the preparation and transportation of the dead.

DUTIES OF THE LOCAL BOARD OF HEALTH.

Upon receiving notice of the existence of a case of diphtheria, the local board of health has important duties to perform immediately and also during the continuance of the case and until the patient has fully recovered and the premises have been disinfected, all of which duties may be summarized as follows:

(a) The premises, or such part of them as may be necessary, must be conspicuously posted with a placard reading as follows: *

* "SECT. 4 [Chap. 16, Laws of 1901]. Whenever a house, tenement, or room is placed in quarantine, a placard shall be posted in a conspicuous position, giving the name of the disease and also containing the following quarantine order: 'All persons are strictly forbidden to enter or leave these premises without special permit from the board of health. All persons are strictly forbidden to remove this card without orders from the board of health.'"

The required placard is furnished free of expense by the state board of health upon application.

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DIPHTHERIA.

All persons are strictly forbidden to enter or leave these premises without a special permit from the board of health.

All persons are strictly forbidden to remove this card without orders from the board of health.

Any person violating these regulations will be prosecuted according to law. When danger of communicating the disease has passed this card will be removed. Per order.

(Signed) BOARD OF HEALTH.

(b) Order prompt and thorough isolation of those infected with diphtheria, and see that the order is thoroughly enforced.

(c) Promptly investigate the origin of the case, with a view to restricting the spread of the disease.

(d) See that no person or family in quarantine suffers for want of attendants or supplies.*

(e) Notify the board of education and the teachers that children from infected premises are prohibited from attending school, and request the teachers to report to the board any cases of sore throat among pupils.

(f) Public funerals of persons dead of diphtheria are strictly prohibited.

(g) See that the premises, clothing and all other articles likely to be infected, are thoroughly disinfected before the quarantine is released and before allowing them to be used by other persons.†

(h) Report to the State Board of Health weekly, upon blanks furnished for that purpose.‡

ANTITOXIN.

It is now the prevalent practice in this state for local boards of health to furnish, at the expense of the city or the town, all the antitoxin required to be used in families not able to pay for the same.

We recommend such action to all boards of health. The use of antitoxin is of such unquestioned value that boards of health are justified in furnishing it, not only as a remedial agent, but as a measure in the interest of municipal economy.

*"Chap. 100, Laws of 1899: SECTION 1. Whenever any person or family is placed in quarantine by a board of health, to protect the public against smallpox, scarlet fever, diphtheria, or any other dangerous infectious or contagious disease, it shall be the duty of said board to assist such person or family while in quarantine in such manner as in the judgment of the board may be deemed wise or necessary.

"SECT. 2. All expenses thus incurred, or such part thereof as the board may determine, shall be deemed a legitimate expenditure for the protection of the public health and shall be charged to the account of incidental expensess, but not to any indigent or pauper account, nor shall such expenditure be construed to mean a public aid to the person or persons so quarantined and assisted, unless such person or persons are already paupers as defined by the Public Statutes."

†"SECT. 6 [Chap. 16, Laws of 1901]. At a proper time after the convalescence or death of he infected person or persons, the board of health shall cause the infected premises to be thoroughly disinfected and cleansed, so as effectually to destroy all contagion, said work to be carried out according to methods indorsed and recommended by the state board of health, after which the said premises may be released from quarantine."

‡"SECT. 5 [Chap. 16, Laws of 1901]. Upon the appearance of either of the diseases named in section 2 in any town or city in the state, the board of health shall make an immediate report to the state board of health upon blanks furnished for that purpose, and shall thereafter make a weekly report as long as the disease continues, stating number of cases, number of infected houses, fatality, and such other facts as may be required by the state board of health."

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BACTERIOLOGICAL EXAMINATIONS.

All cases clinically appearing to be diphtheria should be treated as such from the first; but it not infrequently happens that a microscopic examination is necessary to determine whether certain inflammatory conditions of the throat are diphtheria or not. To aid the physician and the health officer in this direction the State Laboratory of Hygiene is provided with two bacteriological laboratories, one at Concord and the other at Hanover, both under the supervision of the State Board of Health, and from which outfits for the collection of specimens for examination have been sent to most of the drug stores throughout the state, for the convenience of physicians. The examinations are made free of charge.

DISINFECTANTS.

Next to isolation, disinfection is of the most importance in restricting the spread of diphtheria. By the intelligent use of disinfectants the family and the public are protected against the infection of the disease.

Much of the so-called disinfection practised in families is wholly inefficient and useless. The burning of coffee, tar, sulphur, or other substance in the sick-room or in any other part of the house or premises in the presence of the patient or other persons operates, at most, only as a deodorizer, and does not destroy the germs of the disease.

It should also be known that many of the preparations offered for sale as disinfectants, germ killers, etc., are worthless, or nearly so, and should never be relied upon.

Reliable formulas are given by which a family may make disinfectant solutions possessing the required strength and efficiency, and at much less cost than is asked for proprietary preparations.

DISINFECTANTS TO BE EMPLOYED.

For general household purposes during the continuance of a case of diphtheria, or at other times when needed, the following formulas for disinfectant solutions are both satisfactory and cheap:

Solution No. 1.

Chloride of lime (bleaching powder), one pound; water, three gallons. Mix. Cost, about three cents per gallon.

Care should be taken to obtain *fresh* chloride of lime.

This solution is so cheap that it can be used with great freedom, and it is one of the best disinfectants known. A quart or more per day may be used in an offensive vault, and such quantities as may be necessary in other places. It may be used in a sprinkler in stables and elsewhere. In a sick-room it may be used in vessels, cuspidors, etc. Sheets and other clothing used by the patient may be immersed in a pail or tub of this solution, diluted (one gallon of solution to ten of water), for two hours, or till ready for the wash-room or laundry. This solution is non-poisonous and does not injure white clothing.

It may also be used for washing the hands or other parts of the body which may have been exposed to infection from excreta, etc.

For a free and general use in privy vaults, sewers, sink-drains, refuse heaps, stables, and wherever else the odor of the disinfectant is not objectionable, this

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is one of the cheapest and most effective disinfectants and germicides available for general use. It should be used so freely as to *wet* everything required to be disinfected. Its *odor* does not disinfect—only covers up other odors.

Solution No. 2.

Corrosive sublimate, one ounce; permanganate of potash, one ounce; water, eight gallons. Mix and dissolve. Label POISON. Cost, two to three cents a gallon when chemicals are bought by the pound. Stains fabrics, etc.

Use the same way and for the same purpose as No. 1. The only advantage this has over No. 1 is the fact that it possesses no odor. It is poisonous, but its bright purple color will prevent its being mistaken for any other solution. It should be used in vessels, cuspidors, etc., in case of infectious or contagious disease when solution No. 1 is objectionable on account of its odor. It is not so good a disinfectant for vaults, sink-drains, sewers, etc., as the chloride of lime solution. It should not be kept in metallic vessels.

Solution No. 3.

Dissolve one drachm (60 grains—1.8 ounce) each of corrosive sublimate and muriate of ammonia in one gallon of water. Dissolve in a wooden tub, barrel, or pail, or an earthen crock. Label, POISON. Cost, about the same as No. 2.

Use for the disinfection of soiled underclothing, bed linen, etc. Mix solution with equal quantity of water and immerse articles for four hours. Then wring them out and boil them.

Mixed with an equal quantity of water the solution is useful for washing the hands and general surfaces of the bodies of attendants and convalescents. The latter only by direction of the physician.

Solution No. 4.

MILK OF LIME (QUICK LIME).

Slake a quart of freshly burnt lime (in small pieces) with three fourths of a quart of water—or, to be exact, 60 parts of water by weight with 100 of lime. A dry powder of slaked lime (hydrate of lime) results. Make milk of lime not long before it is to be used by mixing one part of this dry hydrate of lime with eight parts (by weight) of water.

Air-slaked lime is worthless. The dry hydrate may be preserved some time if it is enclosed in an air-tight container. Milk of lime should be freshly prepared, but may be kept a few days if it is closely stoppered.

Quick lime is one of the cheapest of disinfectants. This solution can take the place of chloride of lime, if desired. It should be used freely, in quantity equal in amount to the material to be disinfected. It can be used to whitewash exposed surfaces, to disinfect excreta in the sick-room or on the surface of the ground, in sinks, drains, stagnant pools, etc.

Solution No. 5.

Solution of formaldehyde (formalin), six ounces; water, one gallon. Mix. Cost, eight or ten cents. Contains a little less than two per cent. of formaldehyde.

This solution may be used in the same manner as those above described. It

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has the advantage of not bleaching fabrics, and is especially good for washing furniture, woodwork, etc.

The disinfecting solutions above given are for use in connection with the patient during illness, and for such general family use as may be indicated. In other words, nothing should be allowed to go from the sick-room until after it has been disinfected with one of these solutions. It should be one of the unceasing duties of the nurse or other person or persons attending the patient to see that disinfection as herein indicated is carried out daily and to the minutest particular.

DISINFECTION OF ROOMS, CLOTHING, ETC.

After the termination of a case of diphtheria, it is the duty of the local board of health to see that the infected room or rooms, together with all furniture, clothing, and all other articles that may have become infected are thoroughly disinfected.[1]

PREPARATION OF ROOMS.

Whether formaldehyde or sulphur is to be used to disinfect the rooms, contents, etc., it is necessary first that the windows, doors (with the exception of the one which is to give exit to the operator), registers, openings into chimneys, keyholes and all other apertures through which air can pass shall be sealed. In other words, the rooms should be made as nearly air-tight as possible. Gummed paper, put up in rolls, is made for this particular purpose. In lieu of it, however, common newspaper, cut into narrow strips and thoroughly wet, may be used, as it will remain in position long enough for the purpose. The paper used for sealing the cracks, whether gummed or not, should be wet with a solution of formaldehyde (Solution No. 3), in order to disinfect the surfaces upon which it is to be pasted.

All surfaces should be exposed as much as possible; closet doors opened and their contents, together with the contents of drawers, removed, scattered about, and the drawers left open; mattresses set on end, pillows, bedding, clothing, etc., suspended from lines stretched across the room or spread out on chairs or other objects so as to expose all sides; books opened and the leaves spread—in short, the room and its contents so disposed as to secure free access of the gas to all parts as fully as possible. Upon this preparation largely depends the thoroughness of the disinfection.

DISINFECTION BY FORMALDEHYDE (OR FORMALIN).

Formaldehyde has been extensively used in this state following smallpox, diphtheria, scarlet fever, and other diseases with complete success. Indeed, so much so that we regard it as far superior in every respect to sulphur. All floors, carpets, upholstered furniture, etc., should first be sprinkled, or sprayed, with water to the amount of a pint or two to each thousand cubic feet of space, for the reason that a certain amount of humidity adds greater effectiveness to the action of formaldehyde. The room should be warm, about 70° F.

Our experience has proven the so-called "sheet process" to be thoroughly efficient, the only apparatus required being a spray-producer, or sprinkler, thus saving an expensive outfit and dispensing with the use of fire. The process is substantially as follows:

For every 1,000 cubic feet of space in the room is suspended, by one edge, an

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ordinary bed sheet (2x2½ yards) from a line stretched across the middle of the room. Properly sprinkled this will carry without dripping eight (8) ounces of formalin—the 40 per cent. solution of formaldehyde—which is sufficient to disinfect 1,000 cubic feet of space. As many sheets as necessary are used, hung at equal distances apart. The ordinary, rather coarse, cotton sheet should be used in order to secure rapid evaporation.

The sprinkling is done by means of a spray producer, as it is found by long experience that the freest evolution of the gas, with the minimum production of paraform, is secured from very minute drops of the solution, individually scattered on the evaporating surface—not touching or running together.

When all is in readiness in the room, the disinfector ties a damp towel over his mouth and nose, and, beginning with the sheet farthest from the door of exit, rapidly sprinkles each sheet on his way out, being careful to spray evenly and no space more than once.

The evolution of the gas is so rapid that the air becomes irrespirable in about three minutes, so that quick action is necessary. It has also been found necessary to provide the operators with surgeon's rubber gloves to protect the hands and wrists from the spray.

The room is left closed not less than five hours, after which it is opened up as freely as possible to light and air; the family is instructed to have all woodwork well scrubbed with soap and hot water or with the Solution No. 3 or Solution No. 5.

SULPHUR FUMIGATION.

Fumigation with sulphur has long been regarded as a reliable method of disinfection, but it has been largely superseded by formaldehyde. However, it may be used when thought advisable and under certain conditions. It has the disadvantage of being a bleaching agent, and might, therefore, destroy many articles of furniture, clothing, etc. In old buildings, lumber camps, and other places where it is impossible to seal the room or infected area, sulphur fumigation may have some advantages, in that a large amount may be consumed, thereby perhaps securing greater penetration and possibly with more effective results than could be obtained with formaldehyde.

The method of preparing rooms and distributing articles therein is the same as described above, with the exception of such as would be ruined by sulphur fumes.

Close the room as tightly as possible, place the sulphur in iron pans supported by bricks placed in wash-tubs containing a little water; set it on fire by hot coals, or with the aid of a spoonful of alcohol, and allow the room to remain closed for twenty-four hours. For a room about ten feet square, at least three pounds of sulphur should be used; for larger rooms, proportionally larger quantities. Heavy woolen clothing, silks, furs, stuffed bed covers, beds, and woolen articles, which cannot be treated with disinfectants, should be hung in the room during fumigation, their surfaces thoroughly exposed, and their pockets turned inside out. Afterward they should be hung in the open air, beaten and shaken. Pillows, beds, stuffed mattresses, upholstered furniture, etc., should be cut open, and their contents spread out and thoroughly

[1] See law, footnote, page 31 (Sect. 6).

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fumigated. Carpets are best fumigated on the floor, but they should afterward be removed to the open air and thoroughly beaten.

It should be borne in mind that membranous croup and diphtheria are now considered to be the same disease, differing only in symptoms. Under these two classifications there were recorded 3,279 deaths in this state from 1883 to 1903, inclusive. Of this number, over one third, or, to be exact, 1,124, died of the croupous form of the disease. These figures show an average of 164 deaths annually from these two forms of the disease.

Boards of health must carry out the necessary disinfection after a case of diphtheria. This work must be done by the board of health itself, and not be left to the family. (See section 6, near bottom of page 243.)

The period of incubation in diphtheria may vary from several hours to a week, the usual time being from two to five days.

Diphtheria is so widely distributed a disease that it may appear at almost any time in any community, therefore symptoms of it should receive immediate attention, and especially if the disease is known to exist in the locality.

The term "diphtheritic sore throat" is a misnomer in every particular; it is unscientific and misleading as ordinarily applied. The patient either has or has not diphtheria. The kind of infection that exists in a mild sore throat cannot be positively determined by its appearance. It may be tonsillitis, or it may be diphtheria; therefore such cases should not be neglected.

The following, which occurred during the present month, will serve as an illustration: There were several cases of mild sore throat in a family in this state. After a few days a physician was called in and pronounced the cases tonsillitis, but took a swab and sent it to the State Laboratory of Hygiene. A diagnosis was made by smear, and information telephoned to the physician within an hour that the case was diphtheria. Two hours later the physician telephoned that the child was dead.

Statistics covering many thousands of cases in which antitoxin has been used prove beyond all controversy its remedial and preventive value. All families should, without the least hesitancy, acquiesce in the physician's suggestion that antitoxin be administered.

Physicians are invited to avail themselves of the opportunities of the State Laboratory of Hygiene in the diagnosis of doubtful cases. Outfits may be obtained at almost all the drug stores, or they will be mailed direct upon application.

Local boards of health are urged to require at least two negative bacteriological examinations after the patient is convalescent, before discharging a case from quarantine. This method where tried has been found not only to shorten to a very marked degree the length of quarantine in some cases, but it also ensures greater safety to the public.

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Pets of all kinds should be excluded from the room in which there is a case of diphtheria. Dogs and cats may readily carry the infection to others.

The law which requires physicians to report every case of diphtheria to the local board of health is as follows:

"SECT. 3. [Chap. 110, Public Statutes.] It shall be the duty of every *physician* who attends upon any person infected with the *smallpox*, the *malignant cholera, diphtheria, scarlet fever, or other malignant pestilential disease,* to immediately report the same to the health officers or the selectmen of the town; and if any physician shall neglect so to do he shall forfeit the sum of one hundred dollars, to be recovered by such health officers or selectmen in the name of the town."

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PUBLIC HEALTH LEGISLATION, 1903, WITH COMMENTS.

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SOME SANITARY LEGISLATION, 1903, WITH COMMENTS.

SANITARY CONTROL OF PUBLIC WATER SUPPLIES.

Hitherto there has been but little authority in this state to protect the public against the dangers of contaminated water supplies. It is true that local boards of health have had the right to close polluted wells or springs under certain conditions, upon the approval of the State Board of Health, but there was no provision adequate to meet exigencies of greater magnitude along these lines. Corporations might supply the public with a dangerous water with impunity so far as any local or state authority could interfere.

To meet this condition the recent Legislature enacted a measure giving the State Board of Health power to prohibit the use of such supplies under heavy penalty, and giving the Superior Court jurisdiction in equity upon application of the State Board of Health to enforce its orders.

The act gives great authority upon the State Board of Health. Following is the law:

AN ACT to enable the State Board of Health to prevent contaminated water being furnished for domestic consumption.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. Whenever the State Board of Health, upon investigation become satisfied that a well, spring or other supply of water, used for domestic purposes, has become polluted so as to endanger the public health they are authorized to prohibit the person or corporation, owning or controlling said supply, from furnishing such water for domestic purposes, until they become satisfied that said water supply has been purified and made fit for domestic use. Any person or corporation official or agent violating the order of the board shall be punished by a fine of not less than one hundred dollars and not exceeding one thousand dollars for each and every day they continue to furnish water for domestic purposes after the order of the board has been served upon them.

SECT. 2. The Superior Court shall have jurisdiction in equity upon application of the State Board of Health to enforce the orders of said board issued in accordance with the provisions of section 1.

SECT. 3. This act shall take effect upon its passage.

Approved, March 3, 1903.

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SPITTING IN CERTAIN PLACES PROHIBITED BY LAW.

In the April, 1902, *Bulletin*, under the subject of The Spitting Nuisance, we said:

The nasty, disgusting, unnecessary and dangerous practice of spitting on the floors of public buildings, stores, sidewalks and certain other places should be stopped by the strong hand of the law or by municipal regulation. It can be done, as has been demonstrated in many localities. What a spectacle to see long skirts trailing through tuberculous sputa, tobacco juice, and catarrhal expectorations, carrying disease germs perhaps to many households! Although the trailing skirt is to be condemned from every standpoint except that of the dictates of fashion, even the universal adoption of the costume of Pocahontas would not in the least justify the filthy practice. There is no excuse for the habit. It is based upon ignorance, thoughtlessness and indifference to decency. Let it be stopped. A state law should be enacted making it a penal offense to commit this nuisance.

It is a pleasure to announce that this matter has been duly considered by the Legislature, and the following enacted:

AN ACT to promote cleanliness and to protect the public from the disease commonly known as consumption.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. It shall be unlawful for any person to spit upon any sidewalk in the compact part of any city, village or town, or in any railway station, hall or other public place, or in any street or steam railway car other than smoking cars, except into spittoons or other receptacles provided for that purpose.

SECT. 2. All persons keeping fruit for retail sale adjoining a sidewalk in the compact part of any village or city shall provide for public use a suitable receptacle for waste matter upon the outside of such store and adjoining or upon such sidewalk.

SECT. 3. Said receptacles mentioned in sections 1 and 2 shall be kept clean and wholesome.

SECT. 4. It shall be unlawful for any person to throw upon the sidewalk, or into any public street in the compact portion of any city or village, any waste matter from any fruit or any paper or other offensive or unsightly substance.

SECT. 5. Any person violating the provisions of this act shall be punished by a fine not exceeding ten dollars.

Approved, January 29, 1903.

It will be seen by a careful reading of the above that this law is specific in its requirements, but does not demand anything that any person cannot comply with without inconvenience. The law can be enforced if the proper local authorities will do their duty, and that, too, without hardship to any one.

Expectorating in such places as are mentioned in this law is a habit and nothing else. It is no inconvenience to step to the edge of the sidewalk

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and spit into the street. The person who will not do that is either thoughtless or has no regard for decency.

It will require only a little education and a little effort on the part of local authorities to bring about all that the act contemplates.

The title of this law is significant in that it names the one great disease, consumption, which is largely disseminated by this filthy practice.

That the law can be enforced has been demonstrated by municipal action in many places outside of this state, and in a few localities in it. Immediately following the passage of the act placards, stating its provisions, were posted in the City of Concord by order of the local board of health. To give some indication of the results accomplished we quote from an editorial in one of the leading papers of the city, written about two weeks after the posting of the notices. It says:

"They don't spit on the sidewalks now! A wonderful change has come over the appearance of the streets.

"Formerly, men used to gather in hallways, leaning up against the doors and windows on the main streets, and converting the sidewalks into cuspidors. If you are out these evenings you will notice that men still stand about the streets, but they stand nearer the edge of the pavement, and so are able to use the gutter for the purpose for which they formerly used the sidewalk."

In order to bring about such results the public must necessarily be informed of the law, and this can be done by posting suitable notices in numerous public places, in the streets, etc., giving the provisions of the law, and we would suggest that every local board of health see to it that this is done at once. It is one of the greatest sanitary measures that can be inaugurated, and it is the duty of every board of health to see that the law is respected. The police in every town and city should be instructed to enforce this law.

We recommend that local boards see that placards calling attention to the law be posted in every city and village in the state. Cards like samples given herewith (size 9 x 11 inches) will be furnished by the State Board of Health upon application:

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SPITTING

On the Sidewalk or Floor of any car or Public Building is

FORBIDDEN BY LAW

FINE $10.

The State Board of Health calls attention to the following statute:

"It shall be unlawful for any person to spit upon any sidewalk, in the compact part of any city, village, or town, or in any railway station, hall, or other public place, or in any street or steam railway car other than smoking cars, except into spittoons or other receptacles provided for that purpose.

"It shall be unlawful for any person to throw upon the sidewalk, or into any public street, in the compact part of any city or village, any waste matter from any fruit or any paper or other offensive or unsightly substance.

"Any person violating the provisions of this act shall be punished by a fine not exceeding ten dollars." [Chap. 2, N. H. Sess. Laws, 1903.]

IL EST DEFENDU PAR LA LOI

DE CRACHER

sur le Trottoir ou sur le Plancher d'aucun Char ou d'une Batisse Publique.

AMENDE $10.00.

Le Conseil d'Hygiène de l'Etat appelle l'attention sur le statut suivant:

"Il sera illégal pour quiconque que ce soit de cracher sur aucun trottoir, dans la partie compacte d'une ville, d'un village ou dans une station de chemin de fer, dans une salle ou autre place publique, ou dans aucune rue ou dans un char de chemin de fer à vapeur autre que les chars fumoirs, excepté dans des crachoirs ou dans d'autres receptacles pourvus a cet effet.

"Il sera illégal pour toute personne quelconque de jeter sur le trottoir ou dans aucune rue publique dans la partie compacte d'une ville où d'un village, aucun rebut de fruit ou de papier ou autre substance offensive ou désagréable à la vue.

"Toute personne violant les articles de ce règlement sera puni d'une amende n'excédant pas dix piastres." (Chap. 11, Lois Sess. 1903.)

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SUSPECTED SMALLPOX CASES.

It is a fact that smallpox has so rarely occurred in New Hampshire until within a few years that a great majority of the physicians of the state are wholly unacquainted with the disease, and in the mild type in which it has been prevailing recently they are often unable to differentiate it from certain types of chicken-pox, or some other eruptive disease.

It has been the practice of the State Board of Health, when called upon, to send some physician who has had a larger experience with the disease to make the diagnosis. This practice, heretofore, was not specifically authorized by public statute, but was ordered by the State Board of Health as a public necessity and for the relief of uncertain and doubtful conditions confronting local boards of health.

The last legislature enacted the following law, so that now the State Board of Health may make such investigations for local boards of health under the sanction of the Public Statutes when deemed necessary:

AN ACT in relation to smallpox.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. It shall be the duty of every physician who attends upon any person whom he suspects is infected with smallpox to immediately report the same to the health officers of the town in which said person then resides, or if there be no health officers, then to the selectmen of the town, who shall immediately quarantine such person, and if there be doubt whether such person is suffering from smallpox, then said health officers or selectmen shall immediately notify the State Board of Health and request it to investigate the case immediately. If any physician, health officer or selectmen shall neglect so to do he shall be fined the sum of one hundred dollars to be recovered by the health officers, selectmen or any citizen of the town in the name of the town and for the benefit of the town.

SECT. 2. This act shall take effect on its passage.

Approved March 4, 1903.

MILK AND BREAD TICKETS.

It is said to have been the practice of milk dealers as well as of bakers to sell a certain number of tickets, one to be taken up upon each delivery of milk or bread, and that the same tickets have been used over and over on their routes, reaching perhaps many families, until entirely worn out or their legibility obliterated by filth. Such a package of tickets was exhibited at a hearing before a legislative committee, and it was the consensus of opinion of persons present that they would not care to have such tickets left at their houses. The possibility of conveying disease from family to family by such tickets seemed apparent to the committee.

As a substitute for this method two kinds of tickets which seemed to be perfectly feasible to use, and of considerably less expense to the dealer,

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were shown. One had small coupons to be detached for each purchase, the other so printed as to have a number punched each time there was a delivery.

After due consideration of the subject in the House and Senate the following was enacted:

AN ACT in relation to milk and bread tickets.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. All persons selling tickets for bread, milk or cream shall use some form of coupon ticket which shall be detached by the purchaser as used, or, if single tickets be used, they shall be defaced, punched, or cancelled in some way at the time of sale and shall not be again used as a ticket.

SECT. 2. Any person using such tickets a second time shall be fined ten dollars.

SECT. 3. This act shall take effect on its passage.

Approved March 7, 1903.

THE TREATMENT OF INDIGENT CONSUMPTIVES.

A bill appropriating fifty thousand dollars for a state sanatorium for consumptives passed both branches of the Legislature, but was vetoed by His Excellency the Governor. Immediately after this action the following joint resolution was passed and became a law:

Joint resolution to provide for the treatment of indigent consumptives.

Resolved by the Senate and House of Representatives in General Court convened:

That the state board of charities and correction be and hereby are authorized to send such indigent consumptive patients as are suitable for remedial treatment to a sanatorium for treatment.

Said state board of charities and correction shall pay for the care, treatment, and support of such patients only the actual cost of their maintenance in said sanatorium and shall report to the governor quarterly their actions in this matter.

Persons in indigent circumstances, who themselves or by their relatives are able to pay part of said cost of maintenance, may be admitted to said sanatorium and maintained and treated therein at the expense of the state to that extent that they cannot by themselves, or relatives chargeable therefor, pay such cost of maintenance, when the state board of charities and correction so certify and stipulate the proportion the state will assume and pay.

This act shall not be construed so as to deprive any person to whom aid is rendered of any rights that he may have at the time of his admission to a sanatorium.

To defray the expenses of such consumptive patients in a sanatorium a sum not exceeding five thousand dollars for each of the years 1903 and 1904 is hereby appropriated, and the governor is authorized to draw his warrant for said sum out of any money in the treasury not otherwise appropriated.

This joint resolution shall take effect upon its passage.

Approved April 2, 1903.

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Some comments upon what was accomplished under the provisions of the above joint resolution, may be found elsewhere in this report.

STATE CARE OF THE INDIGENT INSANE.

It is very gratifying to announce that New Hampshire has, at last, adopted a policy for the better care of the indigent insane in the final transfer of all such to state care. This work is to be carried out progressively. The limitation of the number who may receive remedial treatment by order of the state board of lunacy has been removed so that the board may transfer to the state hospital for remedial treatment at the expense of the state such indigent insane persons as it deems best.

After January, 1905, the board is obliged to transfer to the state hospital, pro rata by counties, as many of the insane as accommodations may have been provided for. After January, 1909, the state is to have control of all the indigent insane.

The text of the bill is as follows:

AN ACT to provide for the care and support of the dependent insane by the state.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. The state from and after the first day of January, 1909, shall have the care, control, and treatment of all insane persons who are now cared for by the various counties at the county almshouses; and no county shall hereafter establish any asylum or other additional structure for the care of the insane, nor after said date maintain any institution for the insane, or be liable for the board, treatment, care, or act of any insane person.

SECT. 2. From and after the passage of this act, the state board of lunacy may order the removal of all such dependent insane persons to the state hospital for remedial treatment as in their judgment seems proper, and such persons shall be supported at the expense of the state from money in the treasury not otherwise appropriated.

SECT. 3. After January first, 1905, as rapidly as accommodations can be provided, the state board of lunacy shall begin making transfers from the various county almshouses to the state hospital, of such insane persons as in their judgment seem most suitable, and all such patients, after their removal to the state hospital, shall be maintained therein at the expense of the state. Such transfers shall be made by the state board of lunacy pro rata to the population of the several counties.

SECT. 4. This act shall take effect upon its passage. All acts and parts of acts inconsistent with the provisions of this act are hereby repealed.

Approved March 7, 1903.

MEDICAL REFEREE INSTEAD OF CORONER.

"Coroner's inquest" is a thing of the past in New Hampshire. The office of "medical referee" has been created to take the place of coroners. The law provides for the appointment of sixteen physicians for the state

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to investigate suspected criminal causes of death. It is not infrequently the case that such investigations require a most skilful professional knowledge, and it would seem to be almost remarkable that a law which placed such investigations in the hands of laymen should have remained so long upon the Public Statutes.

The medical referee system, which has been in operation some years in other states, has proven to be far superior to the old coroner system.

It was rather an anomalous feature of the Legislature that the old coroner law was quite extensively amended at the recent session and received the governor's signature April 2, 1903, at 10.24 in the morning, while the law creating the office of medical referee, which abolished the coroner system as well as the amended act referred to, became a law on the same day at 1.05 in the afternoon.

Following is the text of the act:

AN ACT establishing the office of medical referee and amending chapter 262 of the Public Statutes, relating to coroner's inquests.

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. The governor shall nominate and with the advice and consent of the council, shall appoint, in each county, able and discreet men, learned in the science of medicine, to be medical referees in such county as they shall reside.

SECT. 2. The number of medical referees, appointed as provided in the preceding section, shall be as follows: For the counties of Merrimack, Cheshire, Sullivan, Belknap, Carroll and Strafford, one each. For Rockingham and Coös, two each, and for Grafton and Hillsborough, three each; and whenever from ill health or absence from the state said referee cannot act, the county solicitor shall designate a referee from an adjoining county, who shall perform the duties required.

SECT. 3. Said medical referees shall hold their office a term of five years from the time of their respective appointments, but shall be liable to removal from office by the governor and council at any time for cause.

SECT. 4. Each medical referee shall, before entering upon the duties of his office, be duly sworn for the faithful performance of his duty, and shall make examination as hereinafter provided, upon the view of the dead bodies of such persons only as are supposed to have come to their deaths by violence, or unlawful act.

SECT. 5. When a medical referee has notice that there has been found, or is lying within his county, the dead body of a person who is supposed to have come to his or her death by violence or unlawful act, he shall forthwith repair to the place where such body lies, and take charge of the same, and if, on view thereof and personal inquiry into the cause and manner of death he deems a further examination necessary, he shall at once notify the county solicitor of said county, and upon being authorized by said solicitor in writing, shall make an autopsy in the presence of two or more discreet persons, one of whom shall be a physician whose attendance he may compel by subpœna, if necessary, and shall then and there reduce or cause to be reduced to writing every fact and circumstance tending to show the condition of the body and the cause and manner of death,

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together with the names and addresses of said witnesses giving evidence to which record he shall subscribe.

SECT. 6. If upon such view, with personal inquiry, or autopsy, as is required by the preceding section, said referee is of the opinion that the death of the person was caused by violence, criminal or otherwise, he shall at once notify the attorney-general and the county solicitor, and file with each a duly attested copy of the record of the case. Also he shall make a return of the death to the city or town clerk, as required by the laws of the state, said certificate containing all the facts necessary to complete the record as far as possible—as well as a personal description of the deceased for identification.

SECT. 7. The attorney-general or county solicitor on receiving the report of the medical referee and finding some person or persons are probably criminally implicated, shall proceed to execute the laws of the state governing the office which they hold, and shall direct the holding of witnesses as they shall deem necessary.

SECT. 8. If a medical referee reports that a death was not caused by violence or unlawful act, and the state's attorney or county solicitor is of a contrary opinion, nothing in this act shall be construed to prevent either of these officers directing an inquest in accordance with this act.

SECT. 9. The medical referee, with the advice and consent of the attorney-general or county solicitor, may, if he deems necessary, call a chemist or other expert to aid in the examination of the body or of substances supposed to have caused or contributed to the death, and such chemist or other expert shall be entitled to such compensation for his services as the medical referee shall certify to be just and reasonable. A clerk may also be employed to reduce to writing the results of the medical examination, autopsy, etc., and who shall be sworn and shall be allowed reasonable compensation.

SECT. 10. The medical referee, upon the completion of his examination, shall deliver the dead body, upon their claim therefor, to one or more of the persons hereinafter named, and they shall be entitled thereto as follows:

First, the husband or wife, as the case may be. Second, the next of kin. Third, any friend of the deceased. But, if the dead body is unidentified or unclaimed for a period of not less than forty-eight hours following the view thereof, the medical referee shall deliver the body to the overseer of the poor in the town, or to the county commissioner, who shall decently bury the same, or, with the consent of the commissioners or the overseer, it may be sent to the medical department of Dartmouth College, to be used for the advancement of the science of anatomy and surgery, as provided for by the statutes.

SECT. 11. In all cases arising under the provisions of this act, the medical referee shall take charge of any money or other personal property of the deceased, found upon or near the body, and deliver the same to the person or persons entitled to the same; or, if there is any doubt regarding to whom it shall be delivered, this fact shall be made known to the judge of probate for the county, whose directions in the case shall be followed.

SECT. 12. Every medical referee shall render an account of the expenses of each case, including his fees, to the county solicitor, who shall audit and approve the same before it is paid by the county treasurer, and the fees allowed the examiner shall not exceed the following, viz.: For a view and inquiry, without an autopsy, five dollars; for a view and autopsy, twenty-five dollars; and for travel at the rate of ten cents a mile to and from the place of view.

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SECT. 13. When it is deemed necessary by the medical referee and county solicitor to have a physician or surgeon present at an autopsy as one of the witnesses, such physician or surgeon shall be allowed a reasonable compensation to be audited by the medical referee and county solicitor.

SECT. 14. Upon the passage of this act, the attorney-general and secretary of state shall agree upon the form of record books, blank returns, and other papers necessary for medical referees to carry out the provisions of this act, and the same shall be printed at the expense of the state and distributed to the several referees, who shall take care of the same, entering all the work and reports of his office, keeping the books open for the inspection of the attorney-general and county solicitor; but whenever a medical referee resigns or is removed from office he shall turn all the books and papers pertaining to the office over to his successor.

SECT. 15. Sections 4 and 6 of chapter 212 of the Public Statutes are hereby amended by striking out the word "coroner" wherever it appears in said sections and inserting instead thereof the words "medical referee," so that the duties required by said sections to be performed by a coroner shall be performed by a medical referee.

SECT. 16. Chapter 262 of the Public Statutes and all other acts and parts of acts inconsistent with the provisions of this act are hereby repealed.

SECT. 17. This act shall take effect upon its passage.

Approved, April 2, 1903, 1.05 p. m.

MEDICAL REFEREES BY COUNTIES, WITH POST-OFFICE ADDRESSES.

ROCKINGHAM: Harry W. Newell, M. D., Derry, N. H.;
Arthur J. Lance, M. D., Portsmouth, N. H.

STRAFFORD: John H. Neal, M. D., Rochester, N. H.

BELKNAP: Henry S. Beckford, M. D., Belmont, N. H.

CARROLL: Ervin W. Hodsdon, M. D., Centerville, N. H.

MERRIMACK: Granville P. Conn, M. D., Concord, N. H.

HILLSBOROUGH: James T. Greeley, M. D., Nashua, N. H.;
Marcellus H. Felt, M. D., Hillsborough Bridge, N. H.;
George M. Davis, M. D., Manchester, N. H.

CHESHIRE: John D. Proctor, M. D., Keene, N. H.

SULLIVAN: Henry L. Stickney, M. D., Newport, N. H.

GRAFTON: William T. Smith, M. D., Hanover, N. H.;
Jonathan M. Cheney, M. D., Ashland, N. H.;
William J. Beattie, M. D., Littleton, N. H.

COÖS: Ezra M. Mitchell, M. D., Lancaster, N. H.;
Louis B. Marcou, M. D., Berlin, N. H.

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